THE RECOVERY OF HEALTH

WITH A CHAPTER ON
THE SALISBURY
TREATMENT

A. KEIGHTLEY, M.D.

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BY

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TO

MY FIRST AND BEST PATIENT

My Mother.

PREFACE.

THE object of this book is to bring forward a basis upon which doctor and patient alike can found a common understanding and groundwork for treatment, derived from logical and simple deductions arising out of physiological facts. Such provision of a ground upon which they can meet, is, in my experience, very necessary for the establishment of that perfect and co-operative confidence which must prevail between the healer and the sufferer who would be healed, but who, in the ordinary run of our common human nature, cannot be expected to bear his perfect share and part in a work which he does not in the least understand. More and more we find that if we would help the patient in any but the most trivial derangement, we must enlist the potent aid of his understanding; of such understanding alone is born the faith which triumphs over difficulties. And of all difficulties, perhaps chronic ill-health is the most severe.

This necessarily involves the confidence through which alone a long course of treatment can be entered

upon and carried to success. It is the part of the physician to establish this confidence. How shall it be done? There is only one sure and enduring method to be pursued: he must be able to prove his diagnosis and his treatment, to a very marked extent at least, by facts in nature, susceptible of being observed, or followed intelligently, by his patient. Such facts will pertain to those departments of nature which we call physiology and pathology.

The science of physiology is made up of the recorded facts observed in the study of the vital processes.

Pathology consists of the record of the facts observed in the course of study of the various *departures* from what are regarded as the normal vital processes.

Neglected physiological facts lead on to pathological commencements, and these in their turn lead on to the establishment of chronic disease.

To give a simple example:—

A cold draught strikes the mucous membrane of the nose and chills the blood, which is near the surface there. More blood rushes to the spot to rid the system of the effects of this chill. If neglected, this may bring about congestion, The simple means provided by nature to relieve the trouble, really in itself forms the groundwork for diseased and chronic conditions if the life tends that way; *i.e.* if the balance between waste and repair be not maintained. Life perverted means disease. Exaggeration of the

vital processes, disease. The *foundations* of health and disease are thus seen to be similar.

Roughly speaking, there are really a few main physiological facts ; a few digressions from the normal standard ; these digressions supply a foundation of pathological conditions. Such conditions, coupled with a small number of varieties of constitution and temperament, form really the multiplicity of diseases which are known to us. Not alone the variety of germ or ferment counts. The varieties of temperament are factors co-equal with the conditions, not in the original establishment of pathological states, but in determining the nature of the final outcome of such states. Excess of lactic acid may produce one type of disease in the sanguineous temperament, another in the melancholic. Excessive fermentation of nitrogenous foods may mean one disease in a given human type ; excess of carboniferous fermentation, another disease.

In the presence of a subject so simple at its base, what is required is :—

Synthesis in diagnosis ; differentiation in treatment.

If we allow pathological divergence to distract our attention from the underlying unity, our diagnosis will lose in exactitude and we shall not be able to lay the finger of discernment upon the central, the basic point of attack. Darwin's theory of evolution was the brilliant synthesis which shed light upon the

Science of Biology. Darwin was a student and observer of detail; but if he had been troubled with the vast detail which arose after him through the increased number of observers, he might not have been able to synthesize.

With the aid of these main points, clearly borne in mind, it is hoped that the reader may be able to grasp the chief bearings of the physiological sketch which follows, and that it may form the necessary groundwork towards which the efforts of those who hope to lift the heavy burden of chronic disease from their fellow men must tend, if that hope is to be realised.

I desire to acknowledge with many thanks the assistance of the friends who have helped me with their advice in bringing out this book, and the courtesy of Messrs. Longmans and of Messrs. Blackie and Co., in enabling me to provide the figures.

46, Brook Street, W.

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"HOMES" *where dietetic training can be had.*

RECIPES.

THE

RECOVERY OF HEALTH.

CHAPTER I.

HEALTH VERSUS DISEASE.

"Life does not consist in living, but in being well."
—CELSUS.

Health.—What is it to be well? There are few indeed who, from their own experience, could describe a state of health. Theoretically, however, "to be well" implies:—

The balanced and harmonious action and inter-action of all the parts of the body.

Without inter-action, health is impossible. The parts of the body, like the parts of Nature as a whole, are inter-dependent. One imperfect organ, unable to perform its function, must inevitably involve the other organs in disorder, if not in disaster, no matter how healthy these may be in themselves. To suppose that the thorough healthiness of the others, will entirely and throughout life compensate the bodily economy for the loss of that one support, would be dangerously misleading.

What, on the other hand, is it to be ill? There are many who would undertake to answer this question from long and bitter experience. If there be any who think they lack the experience, this fact will probably bring them into line with the majority of mankind:—

The moment the activities of the organs force themselves upon our notice, that moment we may be sure the vital machinery is out of gear.

Sweeping as this statement may seem, it is none the less correct, as thought will show. Its correctness is especially seen in the light of the fact that chronic disease arises from the *prolonged* derangement of some part or function of the body. When we will to move an arm, we are not conscious of a telegraphic message running along the nerves from the brain to the muscles of the arm. Physiology instructs us somewhat in regard to the process, but when we will to make the movement, we will, and the deed is done. If movement does not follow the act of willing, or if, though the arm move, the act is accompanied with pain, we may be sure that something is out of order, either with the nerves or with that upon which the nerves should act. In other words, some part of the organism affected by the movement is unhealthy.

The same rule applies to what are called the involuntary movements. If, for example, the activities of the lungs or stomach obtrude themselves upon us, whether by pains or by noises following these activities, it is certain that the organs in question are not acting in a normal, healthy way.

Must we say, then, that hardly anyone is really well?

It would almost seem so. Few can say that they never suffer pain or inconvenience. Their pains may not be severe, but—

The severity of a pain is no real test of the seriousness of its cause.

The *occasional* colds in the head, coughs, sore throats, stiff joints, constipation, diarrhœa, sleeplessness, skin troubles, flatulence, palpitation, twitching in the legs or fidgets, cramps, lassitude, nervousness, neuralgia in some form or another, backaches, headaches, earaches, toothaches and stomachaches, of which people so frequently complain, may appear trivial as compared with the more violent disorders, but even then they can hardly be taken as signs of health. And when we examine these "simple maladies" or "slight ailments" more closely, we shall find that their consequences, if neglected, may be more far reaching than the consequences of some such acute disease as pneumonia, while the cure of the apparently more serious disorder may be a much simpler process than the cure of one of the "simple maladies."

Acute disease.—An acute disease, such as scarlet fever, takes from two to five days to invade the patient, reaches its climax in another twenty-four hours, and apart from the further period of danger from infection to others while the skin is peeling, disappears as a disease in ten days more. The crisis may be acute, treatment may have to be most skilful if the patient is to recover, but the cure is rapid if it is to be a cure at all.

Pneumonia, as another example of acute disease,

advances swiftly, making its presence felt in such a way that it is impossible to ignore it. For a few days it makes breathing more or less difficult; it induces fever more or less high; it upsets the digestive and assimilative organs; it gives rise to great pain, and then, presto! it has gone. There is a comparatively short and severe hand-to-hand struggle with death, but in the majority of cases the patient is soon in a normal condition again. Sometimes an attack of pneumonia will permanently affect the lungs; but at other times it will tend to clear out the whole system and prove the means of making the sufferer feel "better than ever" for long after the attack has left him.

Chronic disease.—Chronic disease may arise in two ways. It may follow upon acute disease, as the remainder left over from such "explosive" pathological conditions:—

Or chronic disease may not be preceded by acute pathological conditions at all, and may simply be the outcome of a series of slight but numerous digressions from the laws of health, each such digression resulting in disturbances of the balance of health, until at last these digressions assume a permanent and synthesised form. This form then takes on some given type of chronic disease, and may be termed true chronic disease.

A true chronic disease does not appear suddenly. It "grows upon" the sufferer. It is so mild in its approach that hardly anyone gives it serious attention until it has reached an advanced stage and until it has taken firm root in the organism. That is one

reason why it is difficult to cure. Its first symptom may have been a slight pain, so slight that it hardly attracted notice or was waived aside as "not worth fussing over." From time to time the pain may have returned, may have increased, but a little ginger, or perhaps a patent medicine, will have easily removed it. And the cause of the pain? At that time the sufferer probably did not think of causes. Yet long before he noticed any pain, the cause of the trouble was slowly taking hold of his organism, as a root thrives in darkness and obscurity. In the course of years this same cause may suddenly produce what seems to be a new development, just as a mine caves in suddenly after the insidious and prolonged assault of natural, but unnoticed and unseen forces. While the first symptom may have been connected with the stomach, the new development may be in the heart or in the lungs. Then the sufferer at last realizes that he is the victim of some chronic disease, possibly of a disease which many would tell him is practically incurable. Yet it would be folly to give up hope. If he tries violent remedies and these fail to give permanent relief, it is hardly to be wondered at. In the first place, he usually directs the remedies to the effect, to the visible and final result of the disease and not to the cause, which he does not know; which he probably has no idea exists. In the second place:—

His disease has been the growth of years: Should he expect to grow well in a month?

Should he not, from one point of view, expect the

process of his cure to bear at least some proportion to the process of his breakdown?

Take catarrh of the stomach as an example of chronic disease. While presenting few, if any violent symptoms in the first place, except occasional attacks of what has passed for indigestion, it may more surely upset the entire organism than an acute disease, such as scarlet fever or pneumonia. It upsets the work of the digestive organs in general and so impairs nutrition. The blood becomes unhealthy, and this reacts upon the tissues. The irritation in the stomach may act upon the pneumogastric nerve, and thus may give rise to so-called spasmodic asthma. Or the same irritation may stimulate the action of the inhibitory ganglia of the heart; may, consequently, slow the heart's action; may, in extreme cases, stop its action entirely, which, of course, means death. And these are only one or two of the possible results of chronic catarrh of the stomach.

The difference between chronic and acute disease.—It will be seen that between these two groups of disease—the chronic and the acute—there is a great gulf fixed. An acute disease approaches quickly and, as a rule, departs quickly. The physician deals with a well-marked and practically unmistakable malady.

A chronic disease, on the other hand, is insidious in its approach and slow in its departure. Its cause is often obscure and its manifestation has almost always become remote from the original seat of the disease. Infection and recovery, in each case, may be represented roughly in a diagram.

THE RECOVERY OF HEALTH.

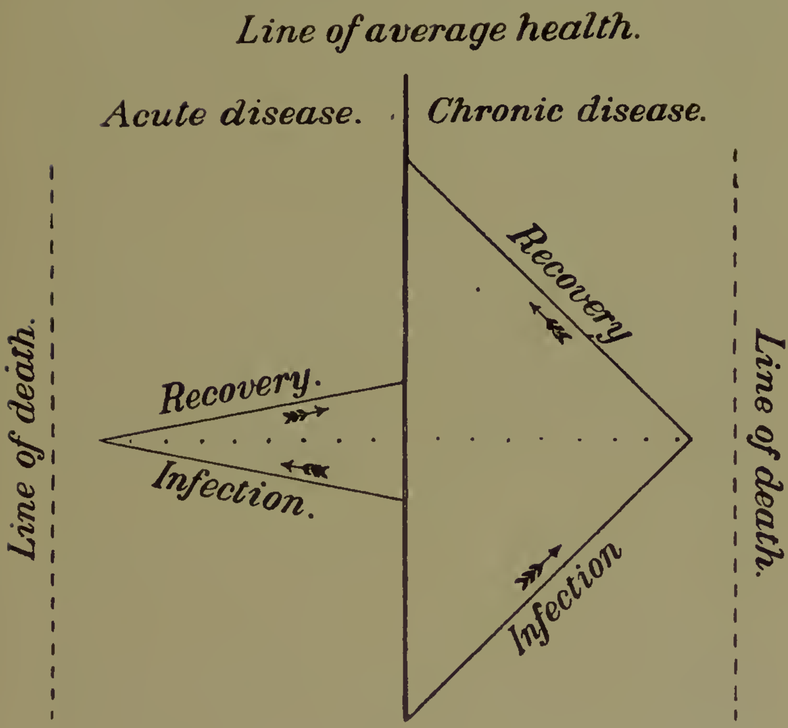

FIG. 1.

Cyclic progress of disease.—It should be understood that the straight lines in the diagram do not properly represent the progress of either infection or recovery. Nature does not advance in straight lines, but in curves and cycles—in ups and downs—to use a more homely phrase. The illustration of the advancing and receding tide will be familiar to everyone. In chronic diseases, this backward and forward movement, taking place along a line of general advance, is particularly deceptive. A sufferer from indigestion, for instance, will often attribute

each separate attack exclusively to some particular thing he has eaten, instead of looking upon the attack as a symptom of a diseased condition. He often thinks that if he had not eaten that particular thing he would have been all right, while the fact is that he would have been as wrong, *fundamentally*, with or without the one thing he has eaten. That disturbing element has only caused the underlying disease to manifest itself in some one of its many acute but temporary forms. When the temporary effect—the disturbance—has disappeared, the disease still is present; it lurks below, unchanged, sinister, threatening. A mistake in eating has merely concentrated the trouble, as it were; which means that the disease is on the ascending arc of its progress and this concentration, this bringing to the surface of a chronic condition, may prove useful if it but call the attention of the sufferer to the need for care and cure. For there can be no doubt that just as in the later stages of chronic disease a patient needs greatly to be inspired with hope—and comparatively few cases are really hopeless—so, in its earlier stages, a judicious infection of fear will often lead to respect for Nature and Nature's offended laws, will thereby prevent more serious developments, and will improve the chances of permanent recovery.

That minor ailments are often precursors of chronic disease, is a fact which is becoming more and more widely appreciated. Yet, for the most part, people remain content to remove temporarily the effects of their indigestion, of their neuralgia, or of any other trouble which they may have: they leave the *causes*

of these effects to take care of themselves. So it may be said that if all people are not actually unhealthy, most people are threatened with ill-health.

Causes and excuses.—Now what are the causes of this unhealthiness? Let us first dispose of the excuses which are sometimes made to pass current for causes, and which people are often ready to present as sufficient explanation of anything. Chief among these excuses is heredity—that "it is in the family."

Heredity an insufficient excuse.—Much might be written upon this subject of heredity; much has already been written. But its popular interpretation well illustrates the truth of the saying: "A little knowledge is a dangerous thing." If someone's father or grandfather died of heart disease, the unfortunate offspring hears of this as soon as he is able to understand language. His life is often passed to the tune of: "Take care of your heart." He gets into the habit of looking upon himself as one overshadowed by the wing of death. He makes himself and every one around him miserable, and in the end he dies, often of old age!

For the sake of a little peace it is sometimes well to admit everything that is claimed against one, and to go several steps in advance of what is claimed. So, in reply to those who attribute all their illness to some forebear who cannot refute their charge, it may be well to side with the forebear by asking what disease they have *not* inherited? The simple fact is that we have inherited the possible development of every known disease. Trace the ancestry far enough, and this will be evident. If some one disease appear particularly threatening, as when a parent has died of

consumption, let us remember that save in few (and even here disputed) instances :—

The utmost we have inherited is the tendency to acquire that disease, and the tendency to live, eat, think, and move in such a way that we provide a fitting soil for its development.

Along with the inherited tendency, we may have to contend with the same environment which fostered the development of the disease in a parent ; for parents are prone to pass on to their children their own habits and mode of living.

Science can modify tendency.—But even so, are we to be governed by tendencies? Is it not the end and aim of Science to alter, adapt, and use the tendencies of Nature so as to make them conform to the wishes and sometimes to the ideals of men? Is not this the whole trend of evolutionary law? Is there not something mean about blaming our parents, or our grandparents, for our own ill-health? What would be thought of a man who, when proved guilty of theft, excused himself on the ground that his mother had been a thief, and that, therefore, he could not help himself? The warning of her example, even if he had discovered the same tendency in himself, should have led him, with that much additional knowledge at his disposal, to a determination to change his tendency by setting up better and healthier activities.

Not for one moment do I look upon disease as a crime ; far from it. But to this extent it is the same with disease as with crime : by setting up better and healthier activities it is possible to change the tendency from a wrong direction to a right one.

It is comparatively easy to turn a scrofulous anæmic child into a strong and healthy man, if you can control the child's activities. That which can be done with a child can be done with a grown man, though in the latter case the process will be more slow, and the control must be self-exerted: it can only be directed by another.

Some other pleas for ill-health.—But heredity is merely one of the innumerable excuses which people make to themselves—and occasionally to others, even to doctors—to account for their own ill-health. They are obliged to live in cities, and this does not agree with them. Or it is the soil, or the dampness of the air, or their occupation, or the after-effect of some past illness. Sometimes the trouble is that certain foods are really necessary to them, and yet do not agree; it matters not whether these foods be sleeping draughts or milk, tea, coffee, or alcohol, or some harmless-looking vegetable—the argument is the same. Such people forget that it is one of the objects of Science to provide conditions which shall counteract the disadvantages of unaided Nature, and of modern life.

Science can modify tendency.—Science, from one point of view, is the art of substitution. Life can be maintained under water for days together, given the apparatus which Science provides, such as a diver's dress, with its appurtenances. It is easily within the resources of Science to provide, if necessary, and in given cases, a substitute for country air, and exercise in that air, in the heart of London, if such necessary adjuncts to a cure can be obtained in no other way.

The inheritance of the body.—Let us consider what it is that we receive from our parents. They give us the house which we inhabit, a body, which, from the primary form of a dual germ, develops into a fœtus and then into a human body ; as such it enters life, the life known to mankind. This body is possessed of innumerable tendencies, of manifold possibilities, and among these, perhaps more immanent than others, but still few among many, are the mental and physiological tendencies of the immediate ancestors. Above all, superior to all, is the tendency of the original germ to assume the human form. That, and that alone, can not be obliterated. Apart from that, this body, this inheritance from our parents, on the entrance into life, may be roughly spoken of as a collection of latent activities, of vibrations, all having the potentiality of manifestation. The possibility is more remote in some cases, in others near at hand, owing chiefly to the conditions of life surrounding the body. These conditions the parents control. These conditions the parents have developed, and, in their turn, these conditions have developed the special tendencies of the parents. The newly-born body is a vibratory soil, teeming with every possibility of life—of both health and disease—and this soil is likely to attract to itself those germs or microbes or vibrations of either state which it, the soil, is best adapted to favour.

The part played by conditions.—Another aspect of the matter is the part played by the surrounding conditions. Throughout the entire scheme of life there is reciprocity, give and take, and the present instance is no exception. A piano tuned to a given

pitch, will respond of itself with the harmonics of a given note played on a violin. And the vibrations of the air, or of the germs and microbes contained in that air, may find an answering vibration in the human body, a vibration imparted to it at its inception, but which might never have developed but for the stimulus of external environment. This idea can be extended by the comparison of the Chladni plate. **The Chladni plate.**—A metal plate, having sand scattered upon its surface, is subjected to the action of a violin-bow drawn across its edge, when the sand is seen to arrange itself in various forms, according to the note of the plate. **Voice figures.**—The "Voice Figures" of Mrs. Hughes are another example of vibration moulding form in plastic substance. According to the external vibrations of its environment, the growing human body is believed to mould itself in somewhat the same way. **Expansion of the child.**—Just as plants may be caused to evolve new colours and more complex forms while retaining the structure of the original type, so the human body may be modified or changed in its tendencies. The child may be expanded in the direction of health and away from the bodily tendencies of its ancestors. Both child and plant would require special care from the outset. Even to mature bodies is this possibility open. It is true of all bodies save those hopelessly diseased from birth, just as imperfect or decayed seeds cannot be developed. All these comparisons with other departments of Nature are not exact parallels ; they only serve to bring the idea more clearly before the mind of the reader.

Our inheritance not a fatality.—Certain exceptions apart, our inheritance is not a fatality; it is not foredoomed. It is pregnant with every possibility of life. It is plastic, modifiable, capable of immense development in many directions. Should not Man, then, look up; should he not hope? Shall he not take control of his temporary dwelling, making it a fitting instrument of his will and of his faith?

A last excuse for ill-health.—Lastly, among the excuses, there is the surprising plea put forward by some people that their disease is surely inflicted by Divine Providence. They have suffered so much and have been so helpless against it. Now and again a physician will find himself reminded by them of the old text: "Those whom the Lord loveth he chasteneth"; as if the Great Architect of the Universe had planned to dole out rheumatoid arthritis to one, paralysis to another, neurasthenia to a third, as so many rewards of merit! Blasphemous as it may seem, that excuse is given occasionally.

The cause of ill-health.—And the truth, apart from excuses? The truth would seem to be:—

The cause of ill-health, in most cases, is the persistent violation of certain laws of health, these laws of health having been well determined by experiment and observation.

Many sufferers practically admit this proposition by their anxiety to excuse themselves for sheer neglect.

Man his own builder and destroyer.—Few people sufficiently realise how many things man can control,

how many more he can modify, and how few things are actually beyond his control. Disease is one of the things that can be controlled to a much greater extent than most people seem to realise. In fact it may be said that, with certain necessary exceptions, such as infectious diseases and diseases resulting from accidents, ill-health is caused (or permitted) by the sufferer himself.

He has made his body what it now is, even as he may make it healthy or unhealthy hereafter as he wills.

Stern doctrine, perhaps, but surely worthy of further consideration ; brutal in expression, it may seem, or at the least unsympathetic at first sight. But because a fact is a fact and we recognise it to be such, does our recognition of it involve any lack of sympathy? Does the fact that a child has been hurt through its own carelessness or ignorance stop the flow of a mother's compassion? Its ignorance should but evoke her greater tenderness. Disease, suffering, pain, are ever the same in themselves and are not altered in themselves by reason of their origin. In all circumstances they call for our utmost solicitude, our sincerest pity : properly understood, the truth is never brutal.

The statement that we have made our bodies what they now are and have the power to re-make them if we will, cannot be considered further until we have enquired somewhat into the construction and activities of the human body generally. Only then can it be seen why and how it is that everything we eat or drink, every breath of air we breathe, every movement

we make—yes, and to some extent every thought we think, alters the arrangement and tends to alter the character of the human organism. We shall then see in what large measure it is true that health and disease can be controlled by the individual.

A medical exception.—There is but one class of disorders which for our present purpose may be regarded as absolutely beyond the control of Man—the class of disorders caused by accidents; for the extent to which the individual may be responsible for his accident does not affect his treatment.

Infectious diseases.—Infectious diseases come under another category. But even here it should be noted that many of these diseases which were formerly supposed to be beyond control, are daily being transformed to the class of events I have described as the things that Man can modify.

The risk of infection can be very greatly modified, nay, in many cases be completely controlled, by individuals co-operating for that purpose. By proper inspection of milk and of water and of drainage; by the proper sanitation of schools and factories, the danger may be reduced to a minimum. Failing co-operation, the individual, acting for himself, may do much to mitigate the danger. This he may do by looking after his general health and by due attention to the laws of hygiene—matters which will receive consideration later on in these pages. The point now to bear in mind is that infection does not depend solely upon the action of some microbe or germ, but upon the health or ill-health—the resisting power—of the individual. *Health* is impervious to any attack

by these microscopic demons of disease. They are but incarnate tempters, and health, like true virtue, will have none of them. Just as there must be kindred soil in the mind for temptation to enter in and take possession, so must there be kindred soil in the body before these wandering tempters can gain a footing there. It is sometimes urged that the strongest men are often the first to succumb to plagues and pestilences, to fevers and similar disorders. True, but is strength synonymous with health? Evidently not. **Balance is health.**—Balance is health—interaction, equilibrium, and it is possible to have a box of iron covering rottenness and decay. A man may have incipient disease of the lungs or of the heart, and may yet have great muscular strength ; may, up to a given point, be the "typical strong man." That point of decay reached, his power begins to fail, but not until then, and a period of years may pass before this point is reached. **Immunity.**—In the same way a delicate framework often accompanies health, for real health means real immunity, and immunity is the product of balance and normal inter-action ; but the health must be real, not fictitious.

And now let us see if something may not be learned about the way in which the body makes and unmakes itself, constructs and devours itself. Then we shall be in a position to consider how health may be maintained, and how, when chronic disease has gained a foothold, has even gained the upper hand, health may still be regained.

CHAPTER II.

WHAT THE BODY IS AND DOES.

It has heretofore been explained that health consists in the perfect action and inter-action of all parts of the body. Therefore, before entering upon the question of the recovery of health, we must acquire some definite idea of that thing which is to recover health; we must know what the body is, and how it functions: we must gain a general view, at least, of that vital machinery whose derangement means disease.

Disease not a mystery.—Disease is not a mystery. It should not be made into a mystery. Like health, *disease is one form or mode of life*. Disease is in part the effort of Nature to relieve herself and to revert to that equilibrium which is health. People find health an easy matter to understand. Disease should be made as plain to their understanding. They shrink from a comprehension of these painful states. Yet when they come to realise that a physician can only help them to help themselves; when they find that a more widely spread understanding of the methods of the body will do more than anything else can do to assist the recovery of health; when they arrive at a perception of the wonderful inter-action of the bodily

parts; when this inter-action is so clear to them that its free play is seen to be health, its obstruction to be disease;—then indeed they will feel repaid for their study.

Knowledge and faith.—But while they ought to have a general knowledge, a ground-plan of these facts in mind, they do not need to do much thinking about them. General knowledge of a subject and continual thinking about that subject, are two very different things. We know that fire will burn us, and we act instinctively in accordance with that knowledge. We do not spend time in planning how to avoid being burned, should fire come our way. Once a patient has certain physiological laws well in mind, and has embraced them with his reason, he should leave details to the physician, who will do the thinking about them. He should know enough to be aware when he is going wrong and how to rectify this, and also when it is necessary to apply for special help. Some knowledge of Nature on the part of the patient gives understanding. Understanding brings faith. That is what is needed—faith. A cheerful quiet faith in the laws of Nature. Faith in Man's own power to modify, even to conquer his environment. Without some modicum of faith on the part of the patient, the physician can do nothing; he must enlist the reason of his patient.

Worry.—Only too well he knows that worry on the part of the patient can upset any cure or chances of cure.

Study of physiology: neglect and necessity.—The ignorance which prevails in regard to the simplest physiological facts is astonishing. Nor is

this ignorance confined to the class of people commonly regarded as ignorant. A man who, in England, passes as highly educated; one who has spent years at Eton or Harrow, and then at Oxford or Cambridge, and who has left the University with flying colours and with more than one degree, may not know the difference between a vein and an artery. Girls of the same class are generally educated at home by governesses, and know even less of Nature than their brothers. It is not supposed to be quite proper for them to study physiology. Yet they are obliged to live for a life-time, well or ill, in these bodies of which they should know nothing! Mothers are inclined to argue that when they were girls they were not allowed to think about such things; they do not wish their daughters to become blue-stockings or to fill their minds with all sorts of matters much better left to men. If it were to be suggested that boys and girls alike should understand something of the bicycles they ride, if only to guard them against accidents, the mothers would agree; but they do not see the point as to their bodies. So the ignorance continues.

General ignorance of physiology.—A patient of mine, a highly educated man, was astonished when I told him, in connection with a treatment he was undergoing, that the blood flies along the great arteries at about ten inches a second. It was a revelation to him to learn that an amount equal to all the blood in his body passed through his heart and lungs in about forty seconds; that every fragment of his body was constantly being bathed in

blood which a few seconds earlier had been in his heart and a few seconds before that could have been tearing through the veins of his legs. The thought that no part of the body is isolated ; that the ever-flying blood can carry matter from the stomach to the lungs in a few moments of time, and to the brain in but a few moments more, convinced him that the diseased condition of one organ must inevitably affect all organs, and the brain as much as any of them. But why had he not known this as a boy? Why had not his life been lived with that simple fact in mind—sufficiently in mind at least, to guard him against the more foolish and unnecessary indiscretions? Perhaps the time will come when the study of the laws of health will be made compulsory: but fathers and mothers need not and should not wait for that to teach their children how to keep well. And there are fathers and mothers who will have to learn before they teach.

The body as a double pipe.—What is the body? Before going into details, let us try to get a bird's-eye view of it. The body, then, from this point of view, is like a long and very porous pipe. This pipe is surrounded, except at its two ends, by a larger but much less porous pipe. The surface of this outside pipe is the skin.

Both ends of the inside pipe are open. The space between the inside pipe and the outside pipe is full of liquid and other matter. The inside pipe is curved and twisted so that anything poured into its mouth will not travel down too quickly. A great part of that which travels through it, filters into the outside

pipe. When this outside pipe gets too full, so that its external porosity does not sufficiently relieve the pressure within it, the liquid in it filters back into the inside pipe again, and so passes out at the lower end. Thus :—

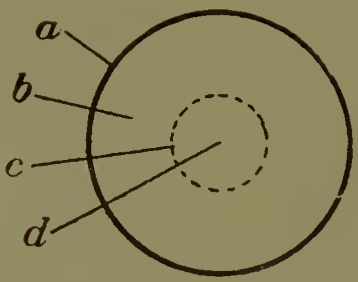

FIG. 2.

(*a*) Skin or sheath of outside pipe (surface of the body).

(*b*) Space, filled with liquid and other matter, between outside pipe and *c*.

(*c*) Skin or sheath of inside pipe (the alimentary canal).

(*d*) Open ends of inside pipe (the alimentary canal). Supposing that the outside pipe were transparent, we might see the diagrammatic figure thus :

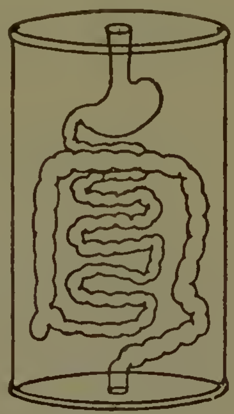

FIG. 3.

Alimentary canal as a factory.—From one aspect the alimentary canal may be compared to a great factory, full of boilers and reservoirs, of living workmen, of complicated machinery and of retainers for acids and other substances used in the processes of manufacture. Yet, from without, all that we perhaps know of this teeming world of production is that a vast amount of raw material passes in at one door, and that at other doors there pass out quantities of waste matter and still greater quantities of substances prepared for human use but not used up. Parts of the raw material have been extracted, have been mixed with other substances, have been made over, and have been converted into useful products: the other parts have been thrown out as refuse.

Supply and demand.—Now, common-sense tells us, among other things, that if this refuse were allowed to accumulate within the factory, the machinery would very soon be blocked. It also tells us that merely to produce articles ready for human use is not sufficient. The articles produced must be distributed throughout the social organism; they must be conveyed to the retail traders and so to the public. But this, again, would be useless, unless, for the things produced and distributed, there existed a demand. Without this demand on the part of the consumer, the factory will have been working at a loss, both to itself and to the social body of which it is a part.

Departments.—The alimentary canal, like the factory, is divided into different departments in which different processes are carried on. Some of these

departments are known as the mouth, the gullet or œsophagus, the stomach, the duodenum, the intestines, the colon, the rectum. Attached to the main factory there are supplementary factories. In these, acids and dissolvents are prepared, some of which are used in preparatory processes, others in the process of eliminating and ejecting waste matters. These supplementary factories are known as the liver, pancreas and kidneys.

Extraction and conversion.—Into this canal, raw material—food in some form or another—is passed. Parts of the raw material are extracted, are mixed with other substances, are made over and converted into useful, or rather into useable articles, and are then distributed throughout the bodily organism by agents and sub-agents. Other parts of the raw material are thrown out as refuse.

Refuse.—It will be seen, as in the case of the factory, that if this refuse were allowed to accumulate, the bodily mechanism would soon become blocked. It will also be seen that unless there exist in the organism a demand for the things produced, these will not be consumed, but will be rejected, and their production will therefore prove a loss to the producer (the alimentary canal), and a loss to the body corporate. Hence we may see the paramount importance of the food we eat and its proper assimilation and distribution. Even the body has its system of political economy!

Combustion.—Before proceeding to a more detailed investigation of this "house not made with hands," let us view it in yet another aspect. Disconnected

as the question may seem, does the reader know what happens when a candle burns? The candle gradually disappears; that is evident. But disappearance does not mean annihilation. In Nature it is impossible to annihilate anything. Things change their form; and the parts of things change their arrangement; but the substance of things for ever remains unchanged in quantity. Water may become solid as in ice; may become invisible, as in vapour; but the quantity of the constituents of the water in all circumstances remains the same. So what really happens when a candle burns is that as the wax disappears, the carbon or charcoal of the wax unites with the oxygen of the air, and that as a result of this chemical union, there are produced water and carbonic acid gas. An object of present utility has disappeared from the world of objects as the carbon and oxygen rushed together, and through the change in the arrangement of its component parts, the atmosphere now contains the object under another form. For our present purpose, the most important point in this connection is to remember that when anything burns, oxygen is withdrawn from the atmosphere, and without oxygen combustion is impossible. In view of this fact, it will not surprise my readers to hear that there is combustion of the body: we may say that the body burns.

The body as a steam engine.—The body has points in common with a steam engine. It is heat which provides both the body and the engine with their driving power. The fires in each require both fuel and oxygen; deprive them of either, and their

fires die down and at last become extinct. Food is the fuel of the body; but instead of burning in one place, as fuel burns in the engine furnace, food is first absorbed by the body, and then burns with the body, of which it has become a part. In other words the body is perpetually being consumed, and the food replaces the consumed material, to be burned in its turn and to be again replaced by other food.

Oxidization.—It is this continual burning of the body which keeps it warm, and it is this heat which enables it to move. This is the vital process—combustion. It is sometimes called oxidization, because combustion involves the union of chemical substances with oxygen. How the oxygen from the air gets into all parts of the body to enable combustion to take place, will be seen later on. Meanwhile we have the central fact that the body burns. As it burns, it gives off water. This it does mainly through the lungs, skin and kidneys. It also gives off carbonic acid gas, principally through the lungs,* and to some extent through the skin. The ashes, the other result of combustion, are, in the case of the body, instanced by the waste materials passed out of the body by way of the kidneys and bowels.

To summarize:

(*a*) *For the human body to move and live, heat is necessary.*

* It is easy to prove that carbonic acid gas is passed off by the lungs. Blow through a straw into a glass of lime-water and you will find that the lime-water becomes milky. If you shake the lime-water with ordinary air, this does not happen. The milkiness results from the presence of carbonic acid gas in your lungs, which combines with the lime and forms chalk, chalk consisting of lime and carbonic acid.

(*b*) *Heat results from combustion.*

(*c*) *Combustion requires fuel and oxygen.*

(*d*) *The union of the fuel and oxygen by combustion results in the formation of carbonic acid gas, water and ash.*

(*e*) *These substances are actually passed out from the body.*

Inasmuch as this vital process is of the first importance, we can readily gather that it must be normally carried out, and that interference, or improper performance would undermine the entire system of Man. The balance between waste and repair, supply and demand, must be preserved. Nutrition in its widest sense must be properly carried out.

CHAPTER III.

THE HOUSE NOT MADE WITH HANDS.

The triune world of the body.—The body, that wonderful habitat of man, is relatively simple in its interior arrangement. For our present purpose, it may be crudely sub-divided (apart from the limbs) into three main divisions, which we shall for the sake of greater clearness call respectively :—

1. The world above the diaphragm.
2. The world below the diaphragm.
3. The supernal world, or the world of the head.

Inter-relation and federation.—We shall find that these three worlds resemble federated States, each having its own system of government and work, but each having, as well, inter-relations with the others in a close bond of inter-dependence and union. Thus these three federated States (the limbs included) may be said to have in common :—

Telegraphy.—(*a*) A telegraphic system.

Circulation.—(*b*) A system of circulation and distribution, corresponding to our industrial and transportation system.

Food supply.—(*c*) A system of food supply, corresponding to our agricultural system.

This metaphor, which we employ for greater clearness, must not be carried too far; it serves a temporary purpose only.

A first glimpse at the body.—What first strikes a student of the body is this: it is not at all what it appears to be. For instance:—

The most evident part of the body is the skin. The skin appears to be an even layer of a simple structure. It is not so, as we shall see later.

Inter-relations of bodily parts.—It would appear that the organs of the body are relatively detached or disconnected, one from the other. We shall find that all the organs are in close sympathy and inter-relation, through the three systems of which we have spoken above. These systems unite the three federated bodily States in much the same way that similar systems are shared in common by political States federated together. And political States are federated for the same reason as that which unites the main divisions of the body so closely despite the differences in their make up: that reason is, that such union gives a stronger hold upon life.

Effects are not causes.—Again, when we shall have considered the bones and all the organs of the body, we still shall not know how it is moved. When we have ascertained by what means it is moved, we still shall not know what mysterious agent preserves, renews and runs the body. So we must beware of judging the bodily make-up by appearances. When we come, later on, to consider the question of disease, this fact of the close correspondence will be most important to bear in mind. Far too often

the surface effect is taken for the disease itself. The seat of acute but temporary pain is too often hastily judged by the sufferer to be the central throne of disease. And how difficult it then is to dislodge the mistaken idea: how impossible to help the sufferer efficiently, lastingly, until the wrong idea is dislodged!

Flesh, muscle and tendons.—How is the body moved? Beneath the skin there is flesh and fat. This flesh, properly speaking, should be called muscle. Lean meat is muscle. The muscles are slips made up in small bundles, loose in the middle but tied at the ends, an arrangement which facilitates their expansion and contraction. These bands of muscle are fastened to bones, or to tendons which in their turn are attached mainly to bones. Tendons are lighter coloured cords, made of different and stiffer material than the muscles. There is more pull and stay to a tendon. These muscles and tendons are like cords, which, when pulled, pull the bones. When you bend your arm, the muscle of the arm contracts, for muscle has the power to lengthen and shorten. It is by the alternate shortening and lengthening of the muscles that the body is moved. But their work is not unaided; they have confederates which move the muscles in their turn.

Nerves, veins and arteries.—Passing in all directions through the layers or bundles of muscle, are numerous small threads and tubes. The threads are nerves; the tubes, for the most part, are veins and arteries; these are called blood-vessels when spoken of together. Binding nerves and blood-vessels, muscles

and tendons and bones together, there is a fine, stringy material, called connective tissue, which provides a common medium for them all ; the mass of these things form a limb, an arm or a leg. But the nerves are not direct agents ; they are the servants of the will.

Nerves as telegraph wires.—The nerves, starting for the most part in the brain or spinal cord, interpenetrate all the muscles. Muscular action is entirely dependent upon these nerves. If you were to injure the nerves which pass from the spinal cord or brain to some particular muscle, you would cut off all communication between that muscle and your will. In other words, you would no longer be able to move that muscle. So, from one point of view, the nerves are telegraphic wires, along which messages are sent by an operator at one end of the line (in the brain), while at the other end is the receiving and recording instrument (the muscle).

An exception.—There are circumstances, however, when the muscular instrument does not respond to the message sent along the nerves by the will, even when the nerves are acting normally. These special circumstances we shall consider later.

The blood-vessels as common carriers. — All muscles, nerves, tendons and organs of the body require food and renovation in order to exist and do their work. These are supplied by the blood-vessels, the common carriers or agents of transportation and distribution between all parts of the body federate.

Connective tissue.—So we see that the nerves answer to a telegraphic system. The blood-vessels

answer to an industrial system of circulation and distribution. Nerves and blood-vessels have a common road-bed or medium, which serves both systems; this is the connective tissue.

The third, or food supply system, we shall note later on.

The Limbs.—The limbs are groups of muscles, tendons, bones, nerves and blood-vessels, which serve in the transportation and food supply of the body corporate.

The trunk of the body.—The trunk of the body and the head are formed on different plans, though they have their telegraphic and distributive systems in common.

In the trunk of the body there is an outer layer composed of materials identical with those that form a limb. Beneath this outer layer there is a large cavity, extending from the neck to the legs. This cavity is not empty; it is packed with the various organs necessary to the life and functions of the body. It is divided into two parts, which we have agreed to call:—

World above and below the diaphragm.

1. The world above the diaphragm.
2. The world below the diaphragm.

The diaphragm, or midriff, is a curved wall extending across the chest. Feel for the fourth rib from the collar-bone and you will be able to form an idea of the highest point in the curve of this dividing wall.

The diaphragm as a wall.—The wall does not wholly shut off the two worlds from one another: there are three open doors, or highways, between them.

The piercing of the diaphragm.—At one point, the diaphragm is pierced by the alimentary canal, the great agency of food supply, which traverses both the world above and the world below: at this point it is called the œsophagus, or gullet.

At another point the diaphragm is pierced by a great vein, and also by a great artery, both circulatory agents: with these also pass some great nerves.

The organs of the abdomen.—The world below the diaphragm is called the abdomen, or belly. In it are the liver, the stomach, the coils of the intestine or bowel, the kidneys and various other organs to be referred to later. The organs of the lower world relate mainly to the food supply, or the conversion of food into blood.

The organs of the chest.—In the world above the diaphragm, called the thorax, or chest, are the heart and lungs. From the heart there extend, all over the body, tubes of varying size and thickness; these tubes are, for the most part, veins and arteries. The work of the world above the diaphragm relates mainly, as we shall see, to the distribution of the blood, the real food of the body, and to the process of combustion.

The world of the head.—Passing now to the supernal world, the region of the head: apart from several nerves and large blood-vessels, there are two main passages through the neck from the thorax, or chest, to the base of the head.

Windpipe and gullet.—One of these passages is the trachea, or windpipe; the other is the œsophagus, or gullet. The windpipe is in the front part of the

neck, the gullet being nearer to the backbone. Both these passages open into the mouth. The big blood-vessels pass on into the upper part of the head—highways connecting the world above the diaphragm with the world of the head.

The brain and the spinal cord.—The supernal, or head world, is the third large cavity in the body. Like the two other cavities, the thorax and the abdomen, it is by no means empty. It is occupied by the brain. The nervous matter extends all the way down a hollow passage in the spine. This hollow passage, filled with nervous matter, is called the spinal canal.

The matter occupying it is called the spinal cord.

Nerves.—From the brain and spinal cord there extend all over the body innumerable threads of varying thickness. These threads are the nerves.

These threads are distributed very largely to the skin, giving the touch sense. Also they go to the other special organs for the senses of smell, taste, hearing, and sight. Very large numbers are sent to all the voluntary muscles, thus surrounding the fibres of muscle with a network of minute nerves.

Sympathetic Nerves.—The sympathetic system is formed by a number of ganglia or knots in the course of the threads or nerves. The system mainly consists of a double chain of these knots lying on either side of the spine inside the body and extending from the skull to the pelvis. It also includes various threads and knots distributed among the various internal organs. The sympathetic nerves are chiefly supplied to these organs and to the blood-vessels, thus controlling what are called the "involuntary movements" and regulating the supply of blood to all parts of the body.

FIG. 4.

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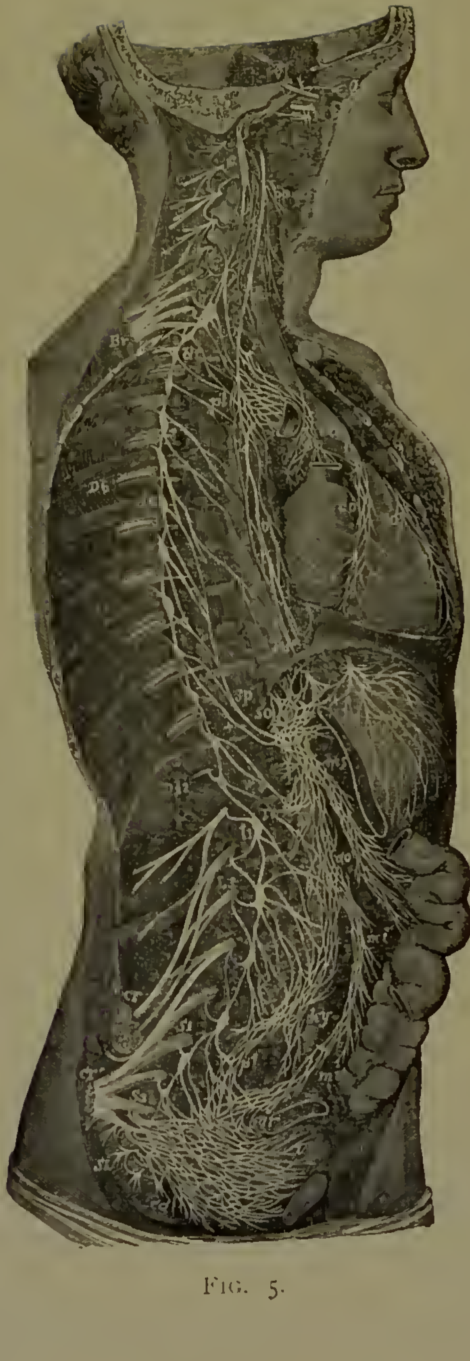

FIG. 5.

Nervous Connection.—Every part of the body is now seen to be connected both with the brain and spinal cord, and with the heart. The brain may be looked upon as the director of the telegraphic system; the heart as the director of the distributive and circulatory system. And it will not be forgotten that the great highway known as the alimentary canal, pierces the body throughout.

Irritability and sympathy of the nerves.—The network of threads which enmeshes the body is termed the nerves. Nerves have various uses. We have alluded to their connection with muscular movements. Their practical omnipresence in the body provides a bond of union and sympathy between the different organs. Thus, if the brain be jarred by a blow, nausea may result on account of the nervous connection between the brain and the stomach. Or, if food be eaten which irritates the stomach, the nerves of the stomach, acting upon the nerves of the brain, will frequently produce a headache. Mental worry or excitement of any kind will affect the entire organism, and particularly the nerves of the alimentary canal, so infinite, practically, are the ramifications and so swift the sympathetic action of the nervous, or telegraphic system of the body.

Serenity of mind and body.—Regularity and serenity of thought largely tend to promote regularity and serenity in all the bodily processes.

The bones.—For the purpose of this sketch it is not necessary to describe the bones: their framework answers to our political framework; it is a constitution upon which the federated union of the body is built

up, and by means of which it has a being and a power of action as a corporate whole in the world of human life. Roughly speaking, every one knows the locality of the spine, the ribs and the skull. Nor need the structure of the joints be understood in detail. It will suffice to say that the ends of the bones are fastened together by flat bands of connective tissue, these bands being called ligaments. The ends of the bones are covered with a tough smooth substance called cartilage. Bone is really hardened cartilage.

Synovia.—A fluid, called synovia, keeps the joints moist and smooth.

Starved muscle not controllable by will.—We have already noted the fact that, under certain special circumstances, the muscles do not respond to normal nerve vibrations. Deprive the muscle of blood, and it is no longer affected by nervous stimulation. Tie a string tightly around the top of the arm, thus keeping the blood from passing into it, and you will soon find yourself unable to move the arm. If you were to choke a single blood-vessel supplying some muscle with blood, so that the muscle were left quite bloodless, you would find that this muscle would no longer be controllable by your will. In like fashion, the messages of the telegraphic wires are useless, even though the wires themselves be in good working order, when there is a congestion of traffic and circulation in any State: the trains cannot be moved on.

The supply of the blood.—Of supreme importance, then, is the conclusion at which we have just

arrived ; that a free flow of blood to the muscles is necessary if they are to do their work.

The supply of the blood.—But what is there about the blood that gives it this mysterious power to bind and to loose? On further investigation, we should find that it is not only the muscles that become useless if the flow of blood be stopped. The brain and the entire nervous system are dependent upon their blood supply for all their activities. So the importance and power of the blood are immense. The blood is the wizard of the body. Why is this?

Oxidization.—In order to answer that question, we must recall what has been said about oxidization, and the continual burning of the body.

Blood as fuel and food.—The statement was then made that food is the fuel of the body. That statement was qualified by another ; that before the food is consumed it is absorbed by the body, and that it then burns with the body of which it has become a part.

Food is the fuel of the body, because food becomes blood and blood not only burns, but it promotes the burning of all the other parts.

Throughout its existence, by far the greater part of the body is continually burning. In the same way, land, the body of the State, is continually being consumed by its consumers, and renewed by its producers.

As soon as the body has ceased to burn, it has ceased to live. But it is the blood that enables the body to burn ; it is the blood that enables the muscle to burn, and thereby to move. The more work a

muscle does, the more it burns and the more blood it needs.

It will now be evident that food does not strengthen the body directly. Food becomes blood and blood is the strengthener. The next thing to learn, then, is how food becomes blood, or rather how food should become blood. For we shall find that certain foods, under certain conditions, do not become blood, and may, indeed, become poisons.

Blood travels.—We can already form a rough idea of the food entering the alimentary canal and gradually filtering out from it to become food. It reaches the outer pipe (see diagram, p. 22); it courses throughout this pipe, through and around all the blood vessels, muscles, nerves, and nerve substances in the body. As it travels through these various parts, each part takes from the blood exactly what that part requires for its own continued burning, and the kindling blood replenishes and revivifies all it touches as it rushes along its fiery path. One part takes one thing from it; another part takes another. Without this circulation of the blood as fuel, neither muscle nor nerve, neither the brain nor any other organ could do its work and live. The ancient saying is borne out: "Now the blood is the life."

How blood travels we shall consider in the next chapter. We have spoken already of the blood-vessels. These common carriers permeate flesh, brain, spinal-cord, skin, bones, lungs and, in fact, almost every part of the body.

The paths of the blood.—These blood-vessels are either:—

1. Veins.
2. Arteries. Or:
3. Capillaries.

They form a tubular web of transportation and circulation arranged on the following plan:—

The veins carry blood *away from* a part.

The arteries carry blood *to* a part.

The capillaries constitute a sort of junction, where blood both comes and goes, and where it also filters into the surrounding tissue.

These arteries, veins and capillaries vary greatly in size.

The arteries narrow as they *approach* the capillaries. Although they narrow, their number increases, so that the total area of blood-vessels is increased. This diffuses the force and rapidity of the blood flow, so that the equable distribution of the materials for supply and excretion is obtained.

The veins narrow as they *recede from* the capillaries.

The tubes of the capillaries are exceedingly fine and narrow, so much so that in the finest only one corpuscle of blood can travel at a time. They are constructed on the principle of narrow-gauge lines.

What blood consists of.—The blood itself is not a simple substance, like water. Being opaque, we expect it to consist, in part, of solids. It does consist of more than one solid. It is a compound substance. Examined through a microscope, it is seen to be full of minute bodies, which are called the blood corpuscles.

FIG. 6.

FIG. 7.

These corpuscles are so small that it has been estimated that there are about 22,500,000,000,000 of them in the adult human body.

The trinity of the blood.—The blood really consists of:—

(*a*) Red corpuscles.
(*b*) White corpuscles.
(*c*) A fluid called Plasma.

This is the trinity of the blood.

Red corpuscles.—The red corpuscles look red when massed. Viewed separately, they look yellow. Pour a very little blood into a tumbler of water, and it will impart a yellow tinge to the water, and not a red tinge. These red corpuscles are not hard; they are elastic; they might be compared to the most minute lumps of red-currant jelly. Notwithstanding their softness they are able to bear a great deal of pressure as they travel through the body. They are not round like balls; they only appear round when looked at from above. Viewed sideways they seem almost flat. A pile of them, as they are seen in healthy blood, bears some resemblance to a pile of old sovereigns, the edges of which have been worn smooth and round. But red corpuscles sink from both sides in the middle, somewhat as a plate sinks in the centre.

White corpuscles.—The colourless, or white corpuscles, are a little bigger than the red. They are generally said to be round, in all directions, though, as a matter of fact, they have no definite and persistent form. They are constantly changing their form, irresponsibly and without sequence as it would seem,

passing from oval to three-cornered, to a square, to mere shapelessness and then to round.

Amœboid movements.—There is reason to believe that these amœboid movements, as they are called, are very far from purposeless, and that they have a direct effect upon the animal economy.

Plasma.—The red and the white corpuscles float in a liquid called the plasma, or liquor sanguinis. This consists of water, in which are dissolved certain mineral salts, with albumen and other substances. More will be said later in regard to albumen.

Clotting of blood.—Blood has a peculiar quality: it becomes solid in certain conditions. This process is called clotting, or coagulation of blood.

Fibrin.—Clotting is due to the appearance in the blood of a substance known as fibrin. Fibrin becomes visible in the blood after the blood has been shed. If we whip freshly drawn blood with a bundle of twigs, as milk is whipped, the blood will not thicken, as the milk does, but presently we find, adhering to the twigs, a pulpy, stringy, sticky substance, which is the fibrin. At first this fibrin is red; when washed in water the colouring matter is removed, leaving the fibrin itself a dirty white. Blood will not clot after being whipped in this way, because the twigs have removed the fibrin. Otherwise, freshly drawn blood, left to stand, clots in a very few minutes. Left standing for several hours, this clot or jelly grows smaller and firmer; but in addition to the clot there would be formed from the original mass, a yellowish liquid called the serum.

Serum.—This serum is the same as the plasma, except that the elements of the fibrin which were

formerly in the plasma, have now gone to make up the clot. As the fibrin consists of innumerable fine threads, it serves to catch the corpuscles. Hence, when the blood clots, the corpuscles are retained by the fibrin in the clot, leaving the serum almost as liquid as water. So the clot consists of fibrin and corpuscles ; the serum of water, albumen, and salts.

Thrombosis and embolism.—What prevents the clotting of blood while it is in the body? We know that blood does sometimes clot, even when in the body, and that this clotting constitutes a disease. Blocked veins are familiar to many, and softening of the brain, as a result of embolism. is known to many friends of the patients. Fibrous tumours, and those cancers of which fibrous tissue forms a large part, also occur to the mind as a possible result of the disturbance between the blood and the body, which tends to the formation of an excess of fibrin.

Fibrin ferment.—Yet ordinarily the blood in the body remains in a fluidic condition. Why? Physiology gives no satisfactory answer to this question. We know that contact with *healthy, living matter* will prevent the clotting of shed blood. We know that the addition of common salt and other saline matters to shed blood will prevent its clotting. We know that in shed blood there is present a certain ferment called fibrin-ferment, and it has been supposed that it is this ferment acting on other elements in the blood which causes clotting. But in any case, all we can conclude from that fact is that the absence, or latency, of this ferment in the healthy body, is one reason why the blood in the body does not clot.

And then blood in the body is not only in unceasing motion as a whole, and some of its constituents as well (we have noted the amœboid movement of the white corpuscles), but blood is also perpetually changing and interchanging its constituent parts with the living matter it touches in its swift flow.

The normal tendency of the body.

The normal tendency of the body is towards health, not towards disease. Even when unhealthy conditions have been established, the underlying effort of nature seems to be in the direction of health, and we shall see later that it is the part of the physician not to attempt the reorganisation of the body according to some plan of his own devising, but to study each body separately, in the light of its individual struggles to regain equilibrium, and to assist by every means in his power, the efforts of nature to readjust herself.

Nature readjusts herself.

CHAPTER IV.

THE BLOOD AND THE LIFE.

The circulation of the blood.—Now the blood is the great circulating medium of the body. It carries to the muscles, to the brain, the skin, the lungs, the liver, the kidney, all that these require for their support. It carries away from them things that it needs and things of which they want to free themselves. The blood never rests. It rushes round and round the body day after day and year after year. Once it ceases to circulate, the organs die. They die of starvation. If they could be fed artificially, without the aid of the blood, they would die just the same, as soon as the blood ceased to circulate; they would be choked by the accumulation of their own refuse, which would no longer be removed. This refuse the blood removes in its passage round and about the body; it removes and it renovates at one and the same time.

Motion and life.—Movement—motion—everything depends upon that. Stagnation means death throughout the whole of Nature; and in the body particularly, motion is a *sine quâ non* of life. We have seen that the blood not only moves, or circulates

as a whole, but also its corpuscles, contracting and expanding—whether through the pressure caused by passage through the body, or self-moved, as in the case of the white corpuscle—are in constant motion as units. There is the mass movement, and the unit movement.

Blood vessels as related to the heart.—It must be remembered, in the first place, that all blood vessels lead either *to* or *from* the heart. The arteries lead from it; the veins lead to it. The capillaries are subdivisions into which the arteries narrow down and from which the veins broaden out. As the main line of a railway broadens out into the "goods yard," with its multiplicity of tracks and increased area for the holding and distribution of the goods carried and then narrows down again into the main line, so also with these paths of the blood. Both the arteries and the veins as single vessels are at their broadest and stoutest at their points of junction with the heart. The blood flows from the heart by way of the arteries, into the capillaries, through them and back to the heart again by way of the veins. We see, then, that arteries are passages to, and veins are passages from, various parts of the body, while capillaries may be compared to irrigation channels in the substance of those parts.

The arteries are simple and continuous passages. The veins are not so simple, because here and there along their course there are small pockets or valves. These valves prevent the blood from turning back when on its way to the heart. The current of blood to the heart forces these valves open without difficulty, but the pockets are so made that pressure exerted

the other way at once fills them up, stops the vein, and thus checks the passage of the blood in any but its destined direction.

The heart: its mechanism and functions.—The heart need not be described at length. Here is a pic-

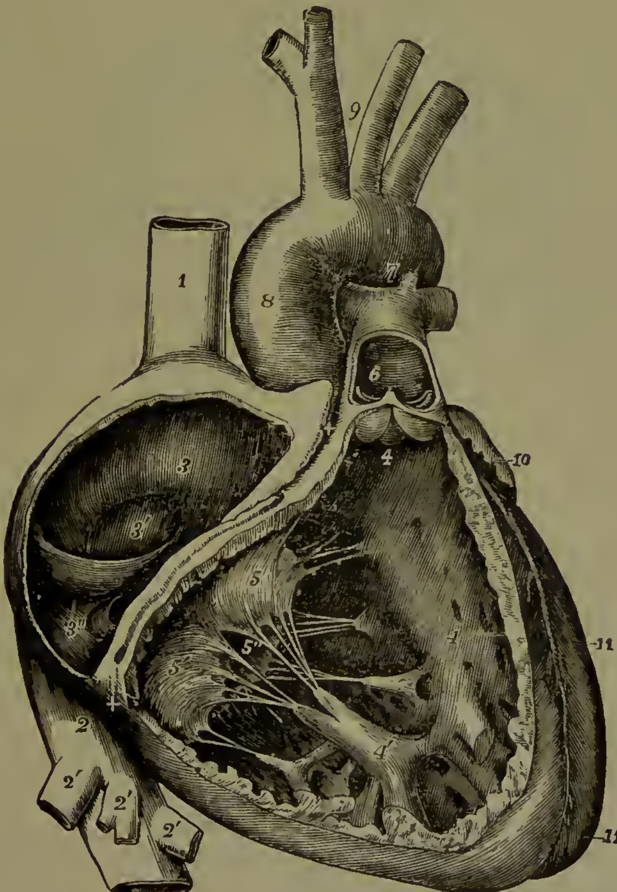

FIG. 8.

ture, showing a sheep's heart, after its removal from the body. It is lying upon the lungs. The arteries and veins have been cut short, and what are seen in the

drawing are their cut ends. The inside mechanism of the heart is rather complicated. It is supplied with an elaborate system of valves. The heart itself is divided into four great chambers, and the valves lead into and out of these. As in the veins, these valves prevent the passage of the blood in the wrong direction, they also, by their sudden and forceful closing and opening, due to muscular action, help to drive the blood through the body.

Of more importance to our present subject than the anatomy of the heart, is the course of the blood through it, to and from the rest of the body. The following diagram should give a very fair idea of the course it takes. It is only a diagram, not to be taken as a rough sketch even, but it conveys the idea. It shows the trunk and the head only, and omits all but the larger arteries and capillary centres. The heart is in the middle. Its four divisions are clearly marked. The names of these divisions are given beneath the figure. The arrows show the course of the blood as well as that of two other substances, to be referred to later, called lymph and chyle respectively. The blood vessels which contain arterial blood are shown by darker lines than those which contain the venous blood.

By studying the course of the arrows in the diagram, it will be seen that the circulation may be considered under two main heads—as the lesser and the greater circulation.

The lesser and greater circulations.—The lesser circulation is that which includes the lungs only. The greater circulation is that which covers the rest

FIG. 9.

of the body. All the blood which leaves the right side of the heart passes through the lungs and returns directly into the left side of the heart. From there

it may travel in two different directions: either to the upper part of the body, into the head or arms, and so back into the right side of the heart; or, it may travel down into the lower part of the body. Once it turns downwards, it has a further choice of two different roads, which meet later on, however, and return as one to the right side of the heart. From the right side of the heart, we have seen that it must pass through the lungs to escape at all.

Now the downward path of the blood from the left side of the heart divides at a point which is shown. One route carries the blood to the lower extremities of the body, and so directly back through one of the great veins to the right side of the heart. The other route sub-divides again. One of these divisions carries blood to the tube marked in the diagram as A 1, which represents the stomach, intestines and some other organs connected with the alimentary canal. This division or branch of the main artery, leading downwards from the left side of the heart, divides into smaller arteries as it approaches the organs of the alimentary canal, and these divide again into capillaries which pass into veins.

The portal vein.—These veins unite as a large vein marked in the diagram as V.P., which stands for *vena portæ*, or the portal vein. This vein passes into the liver, where it again breaks up into innumerable small capillaries.

Hepatic vein.—These unite once more, this time as the hepatic vein, which passes into the same great vein that carries the blood from the lower extremities of the body to the right side of the heart.

Hepatic artery.—But this is only one of the divisions of the "cross-town" route. The other, instead of passing into the capillary system of the alimentary canal, goes straight to the liver and is known as the hepatic artery. Once there it breaks up into small arteries and thus into capillaries.

Hepatic vein.—These capillaries mix with those of the portal vein, and, with them, pass from the liver as the hepatic vein. So, then, the blood which reaches the liver is of two kinds: Arterial blood, direct from the heart; venous blood, which has just passed through the capillaries of the alimentary canal.

Capillaries as tubes of transit and diffusion.—A word or two more about the capillaries. We have seen them to be the minute hair-like tubes which connect the finest ends of the arteries with the finest ends of the veins. The capillaries are so small that they can be seen only with the help of a microscope. They form such a close net-work in every part of the body that it is impossible to pass the point of a needle through the skin without wounding one or more of these capillaries and drawing blood. There is no blood in the body outside the blood vessels and capillaries. All that there is in the body—and we know it to permeate nearly every part,—is contained in these tubes of transit and diffusion. The tubes of diffusion are the capillaries. Their walls are so thin and delicate that the plasma of the blood—the fluid in which float the corpuscles—is able to percolate through into the surrounding tissues.

Disposal of refuse.—From the surrounding tissues there filters back refuse, which can be carried out of

the system in this way only. Certain special organs, such as the kidneys, lungs and skin, help the blood to get rid of this refuse: but the blood carries it from the tissues, and the capillaries collect it for the blood. It is in this way, roughly speaking, that the food we eat passes from the stomach into the blood.

Blood nourished through capillaries.—In this case, however, the substances collected by the capillaries go to nourish the blood; we shall also see later that the blood is nourished through the capillaries in other places besides the stomach, and that they even collect air from the lungs.

Osmosis.—This power of diffusion possessed by the walls of the capillaries is shared by other parts of the body as well. It is a matter of fairly common experience that certain substances will pass through skins and membranes in which no holes are to be found. A bladder filled with salt and water, if placed in a bucket of pure water, will soon flavour the water in the bucket with salt. It is the same with sugar. But not so with starch, for even when boiled, starch does not diffuse through any membrane. In the case of a membrane, such as a bladder, this diffusion is called Osmosis.

The breathing of the blood.—The blood breathes. Without oxygen it dies. This is because the blood burns.

A good deal has been said already about oxidization. We have seen that without oxygen nothing can burn. A candle placed in a sealed jar of pure air very soon uses up the oxygen in the air. As soon as this happens the candle goes out.

Now water contains dissolved air. That is how fish manage to breathe under water. This fact has an important bearing upon the breathing of the blood, for :—

*The blood contains "dissolved" air and carries "dissolved" air to the tissues.**

A fish placed in a sealed jar full of fresh water will die before long, because it uses up the oxygen in the air dissolved in the water, and gives off carbonic acid gas in place of the oxygen. In the same way, unless the air in the blood were constantly renewed, we should find that its oxygen would soon be exhausted and that, in place of the oxygen, there would appear a large amount of carbonic acid gas. For the oxygen passes from the blood in the capillaries to the tissues surrounding the capillaries. By the tissues, as a result of their oxidization, carbonic acid gas is given off. This carbonic acid, in its turn, passes to the blood within the capillaries, and so, by way of the veins, to the right side of the heart. We know which way it goes from there : it goes to the lungs.

The lungs and carbonic acid gas.—Now the lungs are threaded through and through with an enormous number of capillaries. The blood in the capillaries is brought into contact with the air which pervades the lungs, and owing to the power of absorption and diffusion possessed by the walls of the capillaries, the carbonic acid gas, carried by the blood from the tissues, passes from the capillaries into the lungs.

* NOTE.—In this case the oxygen is mainly combined with the colouring matter of the blood.

From the lungs this gas passes out by way of the breath. As the carbonic acid leaves the capillaries, oxygen is absorbed by them from the air in the lungs.

Oxygenation of the blood.—This oxygen mixes with the blood. It is then carried, as the diagram shows, into the left side of the heart, and from there along the great arteries to the capillaries throughout the body. Then the oxygen is once more absorbed by the tissues, while their carbonic acid is absorbed by the blood ; and once more the blood is relieved of the carbonic acid by the lungs, and by them is again re-oxygenated. So the process repeats itself, at each beat of the heart, so long as the body lives.

Venous and arterial blood.—All of these facts are well known, and perhaps do not need confirmation. But one of the proofs of what has been set forth is also, in itself, a fact of interest. It is this : it is found that the blood leaving the heart after oxygenization in the lungs is of a bright scarlet colour. As this blood flows along the arteries it is known as arterial blood. The blood which flows along the veins to the heart, laden with carbonic acid gas, is dark purple in colour. This is known as venous blood. If arterial blood is put under an air-pump, and the gases in it are withdrawn and examined, these gases are found to consist, not of air (air consisting of a great deal of nitrogen and about a fifth as much of oxygen), but of carbonic acid, oxygen, and only a very little nitrogen. Applying the same process to venous blood, it is found to consist of about the same amount of nitrogen, but of much less oxygen and of far more carbonic acid. In the light of what has

been said, it will at once be seen that this decrease of oxygen and increase of carbonic acid in venous blood is due to the action of the tissues.

The lungs.—The lungs, then, are the great purifiers of the blood. To it they give oxygen and from it they take the carbonic acid with which it is burdened. Without this continual rejuvenescence of the blood, the muscles and nearly all the other parts of the body would be choked to death. Here is a picture of the lungs. It shows one on either side extending all the way from the top of the shoulder to the diaphragm. The heart lies nearly in the middle between them. The lungs are two separated air bladders—not ordinary bladders, for they are made up of innumerable smaller bladders. In fact, they may be compared to trees with their branches turned downwards and their trunks upwards. If the trunk, branches, twigs and leaves of each tree were hollow and were made of some delicate and very elastic substance, the result would be a fair representation of the lungs. The hollow branches would then be known as the bronchial tubes; the tiny hollow leaves as the air cells.

The bronchial tubes.—The bronchial tubes and air cells are covered with the closest possible net-work of arteries, veins and capillaries. This is how the air cells exchange part of their contents with the capillaries.

Why is it, if the lungs are constantly giving oxygen to the blood and are as constantly taking carbonic acid gas from it,—why is it, that the air does not become full of carbonic acid and empty of oxygen? It is because the air in the lungs is changed by

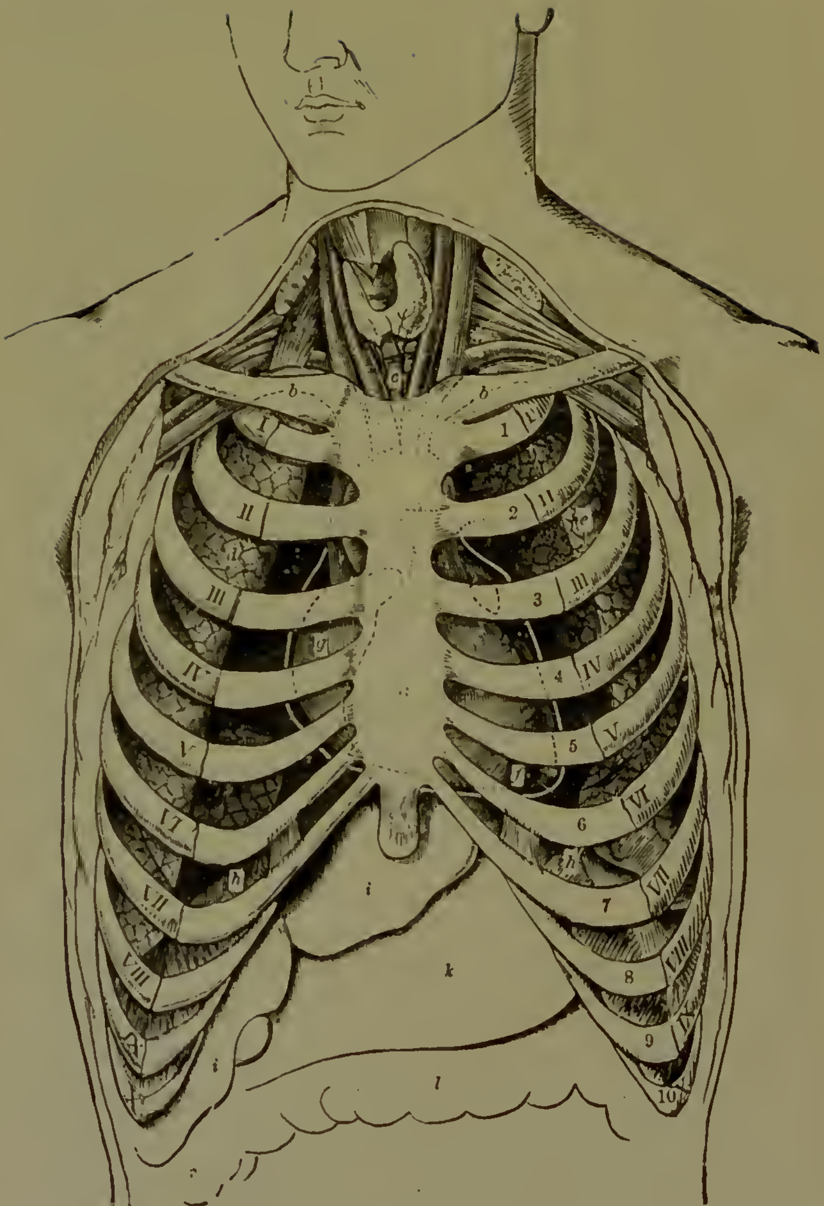

FIG. 10.

breathing. This change of air is as necessary to the blood as a renewal of the blood is necessary to the muscles.

Breathing an involuntary act.—Breathing is what is known as an involuntary act. A conscious effort of the will is not necessary in order to produce the expansion and contraction of the lungs, of which the act of breathing consists. The diaphragm, ribs and muscles of the ribs play an important part in this act of breathing; but for a detailed description of the part they play, I must refer the reader to some physiological text-book.

The brain's share in breathing.—Though breathing requires no effort of the will, it does require an effort of one part of the brain. This part is that point at which the brain joins the spinal cord. Nerves extend from there to the diaphragm and to the muscles connected with breathing. Every time we breathe, a message flies along these nerves from that part of the brain to the diaphragm and the connecting muscles. Without this message of command, the lungs would not take in and force out air, and if that part of the brain from which the message comes were to be injured, the lungs would instantly cease to work.

Stationary and tidal air.—The lungs are by no means emptied and filled at one breath. An ordinary breath carries air down the windpipe only so far as to the larger bronchial tubes—those nearest to the windpipe. It does not carry air to the air cells. The air which is not moved by ordinary breathing is called stationary; that which comes and goes as we breathe

is called tidal. It will at once be seen that there must be a tendency for this stationary air to become overcharged with carbonic acid gas and depleted of oxygen. This is so in the case of short, scrappy breathing. More will be said later in regard to the value of deep breathing. But in no event could one expiration entirely empty the lungs. The stationary air is purified by interchange with the tidal air, taking taking oxygen from the tidal, while the tidal air takes away carbonic acid from the stationary air.

The chemistry of the breath.—Ordinary air, as breathed into the chest, contains twenty-one parts of oxygen to seventy-nine parts of nitrogen. As breathed out, the same air contains only sixteen parts of oxygen, with the same amount of nitrogen, but with five parts of carbonic acid added. The oxygen which has thus disappeared has been retained by the stationary air, which passes it on to the blood in the capillaries. From the blood in the capillaries, the stationary air has taken up carbonic acid, which is then passed on to the tidal air, and so out by the breath. And in this way the blood carries oxygen to all parts of the body, acting as a rejuvenator and purifier wherever it goes.

The feeding of the blood.—But the blood needs food as well as air. The food we eat becomes blood. How? It should be understood from the outset that before food can become blood it has to be dissolved. Solids do not pass into the blood. Yet no matter how thoroughly we may masticate our food before swallowing it, a great deal of our food does pass into the alimentary canal in a solid condition. We shall see that

these solids are dissolved in the alimentary canal, sometimes in one part of it, sometimes in another, according to the nature of the food.

The use of the teeth.—But it may be said at once that it is the part of the teeth to reduce the food we eat to the smallest possible pieces. If this part of the process is not properly performed by the teeth, it throws that much extra work upon the stomach and other organs—sometimes more work than they can do. Quite apart from other processes taking place in the mouth, of which more remains to be said, the importance of biting, crushing, grinding and chewing food thoroughly, can hardly be exaggerated ; still no amount of work by the teeth will actually dissolve food.

Digestion.—So it remains to be determined how this dissolution or *digestion* is carried on.

CHAPTER V.

THE JUICES OF THE BODY.

The skin: surface and interior.—Everyone knows that the skin on the surface of the face and that on the inside of the mouth are different. For one thing, the inside of the mouth is always moist. For another, it is always redder than the outside skin. This is because the skin on the inside is much thinner than the outside skin. Where the skin is thick, as on the heel, or on the palm of the hand, layers of it can be shaved off without drawing blood. If a narrow upright cutting of it were made—going straight down into the flesh—and if this slip were examined under a powerful microscope, it would look like the annexed figure.

The make-up of the skin.—There are no blood vessels in the epidermis. The skin must be pierced throughout in order to draw blood.

Epidermis and dermis.—The epidermis is continually growing from beneath, and is continually peeling off on its surface.

The dermis is not made of cells, but of connective tissue (see p. 31). It is crowded with blood vessels. The surface of the dermis is not regular, but forms

ittle hillocks, usually filled by blood vessels, as shown in the figure. These hillocks in the dermis are crowned with epidermis, all the spaces between the hillocks being filled with the same material.

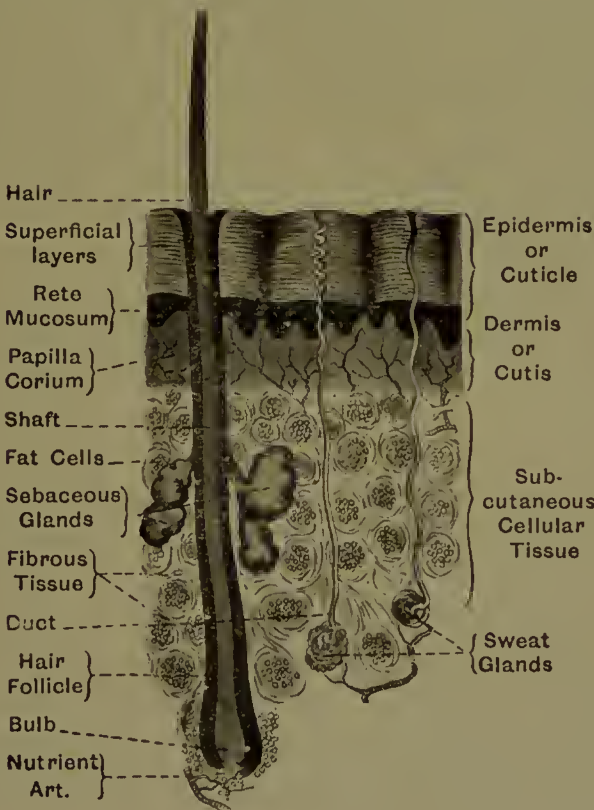

FIG. 11.

Because the dermis is full of blood vessels it is always red. This redness shows on the surface of the skin only in proportion to the thickness of the epidermis, at any one point. Thus, the skin on the face is much thinner than the skin on the heel ; therefore

the skin on the heel shows very little, if any, sign of the red blood beneath it, while the skin on the face is often pink, and is sometimes bright scarlet.

Again, we have seen already that the walls of the capillaries are constantly diffusing the liquid part of their contents. So, as the dermis is full of blood vessels, it is always kept moist. This moisture does not affect the outer skin on the surface of the body, because the epidermis is too thick there to allow the moisture to pass through it.

Many people have very hard dry skins, with a very thick layer on the surface. This layer is apt to peel away and come off in flakes. These flakes are formed of the condensed and compressed layers of the epidermis which are thrown off in consequence of insufficient circulation in the dermis to nourish it and keep it moist. In some cases the outer layer is lifted away because the moisture secreted by the glands alluded to in the next paragraph cannot find an outlet. When such people undergo a forced perspiration, as for instance in a Turkish bath, the layers of epidermis are softened and moistened and their removal by friction is secured. Only those who suffer thus can realize the relief obtained when the proper action of the glands of the skin is restored.

The glands of the skin.—If this moisture does not affect the surface of the body, the question naturally arises, how comes the moisture of the perspiration? By turning once more to the last figure, it will be seen that the surface of the skin is pierced by a narrow channel. This channel passes through the epidermis into the dermis. When it reaches the dermis it

is still lined by a single layer of the cells that form the epidermis. It runs for some distance through the dermis, among the blood-vessels with which the dermis is crowded. Then it ends in a coil. This coil is covered with a fine network of capillaries. In the smaller drawing the network of capillaries is shown apart from the coil enclosed by this network. For the capillaries are wound through and around the tubing of the coil, though they never penetrate into the tube itself.

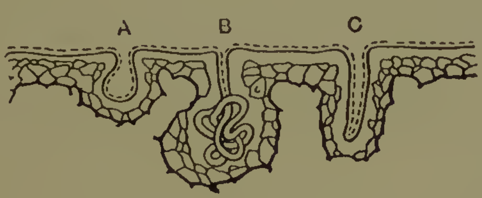

FIG. 12.

B Diagram of coil of sweat-gland surrounded by blood capillaries.

The inside of the coil is always filled with liquid, for the walls of the coil, as of the tube higher up, are formed of a single layer of cells. Hence the fluid part of the blood in the capillaries oozes out through their thin walls, and is sucked in through the thin walls of this coil. In fact, the coil *secretes* liquid out of the blood in the capillaries.

Sweat-glands.—Whenever the capillaries near the coil become crowded with blood, an extra amount of liquid passes into the coil. From the coil this liquid moves along the passage-way to the surface of the skin. On the surface it appears as perspiration. The tube with its coil at the end is known as a sweat-gland and the skin is full of these sweat-glands.

Mucous membrane.—Now it should be clear why the skin inside the mouth is so much more moist and red than the skin on the outside of the face: the epidermis of the mouth is a very great deal thinner than the epidermis of the face. It is so much thinner that the moisture can pass through it from the dermis at almost any point. But in addition to this there are a number of special glands in the skin of the mouth which help to moisten it to an unusual extent.

Epithelium.—Mucous membrane is the name given to the thin, soft skin of the mouth, the outermost layer of which, instead of being called the epidermis, is called the epithelium. But this difference in name does not mean that there is any actual difference in the structure of the skins. They are the same in kind, whether inside or outside the body.

The skin of the alimentary canal.—It may surprise my readers to know that there is an inside skin. Our diagram of the two pipes will not have been forgotten perhaps. The outside pipe was made to cor-

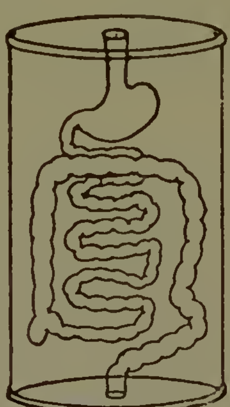

FIG. 13.

respond to the outside skin. The inside pipe was made to correspond to the skin of the alimentary canal. The mouth is the top opening of this canal, and just as the mouth is lined with a thin skin called a mucous membrane, the whole of the alimentary canal is lined with a similar skin, and it is this skin that forms the inner pipe of the two.

Along most of this canal the outermost layer of the skin—the epithelium—is even thinner than it is in the mouth. So the walls of the canal are always red and moist, the blood capillaries being very numerous and very near the surface. Around the mucous membrane of the canal there are muscles, which are also full of blood vessels.

Striped and unstriped muscle.—These muscles are not quite the same as those in other parts of the body : they are called unstriped or involuntary muscles, while the other muscles of the body are called striped, or voluntary. But like all muscles they have the power to contract, and so to pull or to squeeze as the case may be.

The glands of the alimentary canal.—It will be remembered that the outer skin is perforated by sweat-glands and that these open out on to the surface of the body. Now the inner skin, the mucous membrane of the alimentary canal, is also perforated by glands, but these open on to the inside of the canal, and do their work there. Furthermore, instead of being some distance apart from each other, as in the surface skin, they are so crowded together in the alimentary canal that the whole of its membrane seems to be made up of glands.

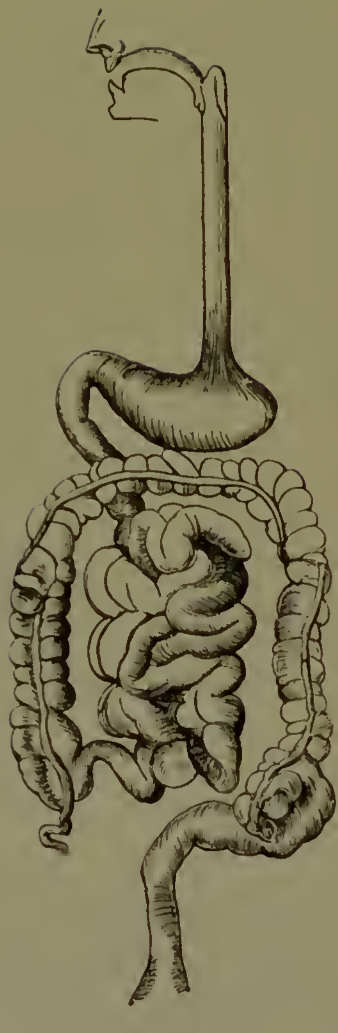

Fig. 14.

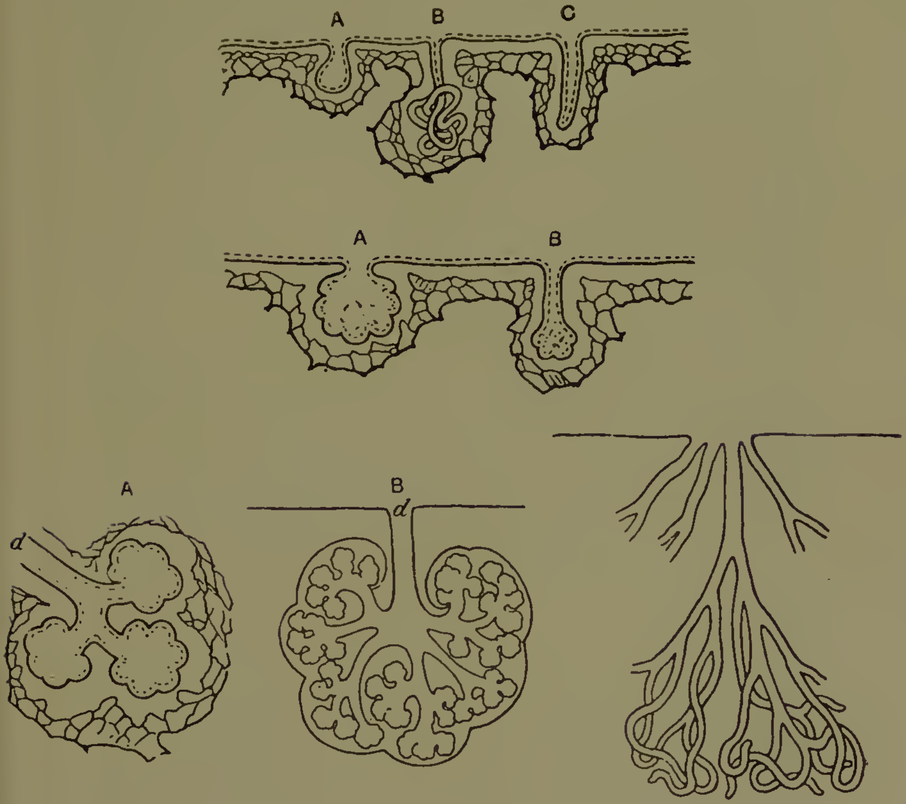

FIG. 15.
Diagrammatic representations of several of the glands opening on the alimentary canal, surrounded by capillaries.

The glands of the mucous membrane, which lines the alimentary canal, are not exactly like the sweat-glands. They vary in shape and size according to their position and according to their purpose.

But all glands are covered with blood capillaries, from which they secrete fluids. The capillaries are the servants of the glands. In the glands connected with the alimentary canal, the fluids secreted pass into

the canal—their mouths opening inwards, instead of outwards as on the surface skin. These fluids are not like the perspiration poured out by the sweat-glands.

Secretion of gastric juice.—The glands in the walls of the stomach secrete an acid juice known as the gastric juice.

Intestinal juice.—The glands in the walls of the intestines secrete an alkaline juice known as the intestinal juice.

The salivary glands.—And there are other glands besides those in the substance of the mucous membrane which lines the alimentary canal.

When I spoke of "supplementary factories," on page 24, I had these glands in mind. Two of them are situated just beneath and in front of the ears; one behind each end of the jaw; two on either side just below the point of the tongue. From the mouth there are two narrow tubes or ducts running towards these glands. The tubes branch off into smaller and still smaller tubes, until at their ends they form a mass of minute tubes, surrounded by blood-vessels, which are all bound together with connective tissue, and thus form the glands in question. They are known as the salivary glands. All of these secrete, from the capillaries surrounding them, a juice known as saliva. From the plenteous supply of these glands and their servants the capillaries, some idea may be had of the important part they are called upon to play in the body corporate. Without these various juices, secreted by the different glands, the food supply would never reach the consumers—the bodily organs and the blood—in any but a semi-raw state, utterly unfit for con-

sumption. In other words, the food could not be assimilated by the body.

The pancreas.—Another gland of the same nature as the salivary glands, though much larger than they are, is called the pancreas. It is situated just below and behind the stomach. The butcher calls this gland "the sweetbread." Its secretion is known as the pancreatic juice. At a point some inches below the stomach, the pancreatic juice passes out into the intestine.

The liver, and its blood supply.—Of a somewhat different construction, though still a gland, is the liver—more talked about, perhaps, than any other of the internal organs, not even excepting the heart. The liver is a very large organ, weighing from three to four pounds. Its upper surface fits closely against the lower side of the diaphragm, or midriff. It has two parts or lobes. The right lobe is larger than the left, reaching down to the intestines and to the right kidney, thus extending over most of the right side of the abdomen. The left and smaller lobe partly covers the stomach, but does not quite reach to the left wall of the abdomen. At first sight the liver might be taken for a mass of nothing but minute capillaries. And at this point it will be well to refer to pp. 52-53, for it is there shown that the blood which reaches the liver is of two kinds: arterial blood, well supplied with oxygen, direct from the heart; and venous blood which has just passed through the capillaries of the stomach, intestines and pancreas.

The secretion of bile.—Now the liver is a huge gland of a complicated kind. Its cells, acting upon

the blood in the capillaries, secrete a fluid known as bile, or gall. The bile is slightly alkaline; it is a fluid which plays a double part. It is a secretion used in the digestion of fats: it is also an excretion (as will be explained later), by which the body is relieved of a large amount of waste, or unused material. By a duct—not unlike the ducts that lead from the two main salivary glands into the mouth—the bile passes from the liver into the top of the intestine. But this happens only when there is food in the intestine; and as the bile is secreted continuously by the liver, when the bile is not wanted it has to be stored somewhere.

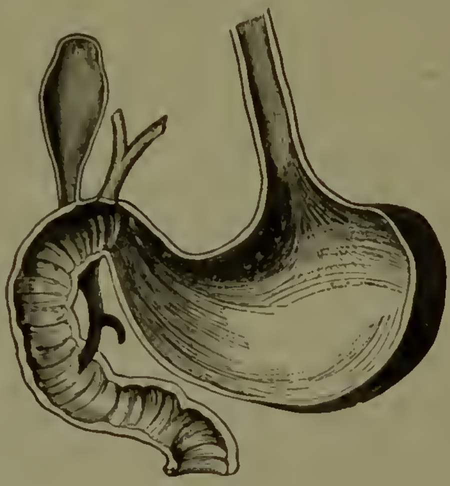

FIG. 16.

The gall-bladder.—This is done in a bladder called the gall-bladder, which the bile reaches by a side passage from the main duct. Such is the importance of the liver that it might be called the doorkeeper of the digestion.

The spleen.—There is also a gland called the

spleen, which is supposed to act directly upon the blood, though comparatively little is known positively in regard to it. This gland lies at the lower left-hand end of the stomach.

Recapitulation.—To recapitulate; there are the glands in the mucous membrane of the alimentary canal, secreting and giving off gastric juice in the stomach, and intestinal juice in the intestines. Then there are the larger and more complicated glands acting as supplementary factories, and known as the salivary glands, the pancreas, and the liver, all of which also pour their contents into the main canal, or factory. Saliva, pancreatic juice and bile are the products of these glands.

The dissolution of food.—Does the reader remember what was said about the food becoming blood? That solids cannot pass as such into the blood; that all foods have to be dissolved, and that the teeth, though they can and should reduce the food to small pieces, cannot dissolve it.

The food supply.—It is these juices and gland secretions that dissolve the food we eat. If the teeth act on the food as a plough with the land, to turn over and to tear asunder, these juices in their turn act like the forces of Nature, the rain and frost and wind, to split up minutely, to dissolve and to melt the food. All this pertains to the third system of which we spoke, that of the food supply.

And now, knowing what we do of the work to be done by these juices, let us see if we cannot trace their action—different in method but one in aim—upon the different foods.

CHAPTER VI.

HOW FOODS BECOME BLOOD.

The make-up of foods.—The first thing to consider in tracing the action of the different juices upon the different foods, is the make-up of the foods. We might roughly tabulate them thus :—

Proteids (or ALBUMINOIDS).

Composed of: Nitrogen. hydrogen, carbon, oxygen, sulphur, or phosphorus.

Dissolved by: Gastric juice of the stomach, aided by pancreatic juice of the pancreas.

Example: Lean meats ; gluten or casein (from milk).

Hydro-carbons (especially rich in carbon).

Composed of: Carbon, hydrogen, oxygen.

Dissolved by: Bile of the liver, aided by pancreatic juice.

Example:—Pure fats.

Carbo-hydrates.

Composed of: Carbon, hydrogen, oxygen, in the exact proportions of water ; also a little nitrogen.

Dissolved by: Saliva of the mouth, and completed by the pancreatic juice.
Example: Starches and sugars.

Mineral matters and water.—All the salts and acids; common salt; potash, lime, magnesium, phosphates, iron, &c.

Chemistry of foods.—We see that the muscular fibre of meat (the lean part of meat), is made up of nitrogen, hydrogen, carbon, and oxygen, sulphur and phosphorus, and that it belongs to the family of Proteids. "Albuminoids" is another name for the same family of foods. The other part of the meat, the fat, which is wrapped round the lean muscle, is differently constituted. Pure fat contains no nitrogen, being made up of carbon, hydrogen, and a little oxygen. It belongs to the family of the Hydro-carbons.

Bread belongs to another great family, that of the Carbo-hydrates. These consist of carbon, hydrogen, and oxygen, like the Hydro-carbons, but they differ from the Hydro-carbons in containing oxygen and hydrogen in the exact proportions necessary to form water. Bread is said to belong to this family because it consists chiefly of starch, and it is starch, properly speaking, that is a Carbo-hydrate.

There is another element in bread, however, beside starch, namely, nitrogen; and nitrogen in a form that closely resembles the proteids present in muscle and blood. The nitrogenous element in bread is known as gluten, but bread, compared with meat, contains only a very small proportion of nitrogen.

Potatoes, which also belong to the family of the

Carbo-hydrates, are almost entirely made up of starch, though even in potatoes there is present but a small quantity of proteid matter. Most vegetables contain starch, with greater or smaller quantities of proteid matter added.

Sugars also are Carbo-hydrates. We shall find that starch must be converted into sugar, before it can be absorbed into the system.

Finally there are the salts. Common salt is usually taken with other foods, but in addition to this, most foods contain salt naturally. Certain acids are also contained in foods. So in this way we are constantly introducing into our bodies potash, lime, magnesia, soda, phosphorus, iron, and sulphuric, hydrochloric and other acids.

Summary.—We may therefore tabulate the foods we eat into four great families, as seen above in the table given.

1. The nitrogenous foods, called the Proteids or Albuminoids, include: Lean meat, white of egg, the curd of milk (cheese), the gluten of flour and certain parts of peas and beans; these are the best known representatives of this family.
2. The Hydro-carbons or fats: Butter, lard, suet, dripping, animal fats in all forms, and vegetable oils such as olive oil, belong to this family.
3. The Carbo-hydrates or starches and sugars: such as bread starch, potato starch, grape sugar, cane sugar, beet sugar, and the sugar in milk.
4. The Salts or Mineral matters: including com-

mon salt, calcium carbonate (chalk), and the phosphates of calcium, magnesium, sodium and potassium, with certain salts of iron and so forth.

Water.—Water may be considered separately. More than two-thirds the weight of the body, as a whole, is made up of water. Water is taken into the system in our food and drink, and it is also formed in the body as the result of oxidization.

Separation of foods from refuse.—Now of all these foods, the water, the salt and the sugar alone can pass through a thin membrane by osmosis. (See p. 54.) If a mixture of meat, both fat and lean, and of bread, salt and sugar were placed in a bladder and the bladder were immersed in pure water, only the sugar and salt in the mixture would pass through the bladder into the water. It is the same with the skin of the alimentary canal. A quantity of meat, or of starch, or of fat, if it were to remain in the same condition as when put into the mouth, would never pass through the membrane of the canal into the blood capillaries. It would almost wholly remain enclosed within this inside skin, as if it were outside the body. Hence the need of the juices of which we have spoken.

Furthermore, most foods are mixed with non-nutritive materials, which have to be separated from the food itself before absorption can take place. This separation of the food from the non-nutritive material with which it is mixed, is also brought about by these juices. These juices, secreted by the different glands, act upon different foods.

Genesis and action of the juices; saliva.—The saliva of the mouth acts upon starchy foods only. Starch cannot pass through a membrane (see p. 54). It cannot be dissolved in water. And it is useless until it has been dissolved. The saliva brings this about by converting the insoluble starch into soluble sugar.

Starch as sugar.—We have seen already that sugar is easily diffused through a membrane. So the sugar resulting from the action of saliva upon starch, when passed into the stomach and intestines, is absorbed by the blood capillaries. If unchanged starchy matter be swallowed, together with saliva, the process of conversion is carried on in the mouth, and for a certain time in the stomach. For it must not be forgotten that the whole purpose of the food is to nourish the blood, and that the blood then proceeds to convey it to the parts of the body. In the same way, in our social system, the produce of the land has first to be taken, and the animal products must also be taken, to the various places where they are first made fit for human use. Then they are conveyed to the great highways of industry and commerce, and are by these transported to be distributed throughout the country. The blood stream through its veins, arteries and their tributaries, serves this purpose of distribution; it even returns "empties," in the form of material voided of its nutriment, to be thrown out of the body!

It is important to remember, then, that bread, potatoes and other starchy substances are absolutely indigestible until their starch is converted into sugar. This is done to a great extent by the saliva of the

mouth. Hence they require a due amount of mastication in the mouth, which, being soft, they do not always receive.*

The action of the gastric juice.—The gastric juice secreted by the glands of the stomach has little if any effect upon starch, but it dissolves proteid matters readily. The active principle of gastric juice is a substance called pepsin. Pepsin, acting with an acid (and there is hydrochloric acid in the gastric juice), has the power to dissolve nitrogenous food. Nitrogenous foods, thus dissolved, are known as Peptones. Peptones can be absorbed directly by the mucous membrane of the stomach, and can so pass into the blood.† The gastric juice will not dissolve fats, any more than it will dissolve starches. It dissolves only the nitrogenous coverings in which the particles of fat are wrapped. So it will be seen that the stomach is an organ in which lean meat and albuminoids can be entirely digested. Starches and fats must be acted upon elsewhere.

The work of the pancreatic juice.—The pancreatic juice resembles saliva inasmuch as it converts insoluble starch into soluble sugar. It finishes up the work of the saliva. But it resembles gastric juice also, because

* If starch be mixed with saliva in a vessel, and the mixture be kept at a temperature of 100° F, the conversion of the starch into soluble sugar will commence immediately.

† If some lean meat be cut up into small pieces, to imitate mastication, and these pieces be mixed with pepsin and a few drops of hydrochloric acid, the meat can be reduced to a pulp, as in the stomach. The mixture must be kept at a temperature of about 100° F, and must be stirred with a glass rod frequently, to reproduce the natural churning motions of the stomach.

it dissolves nitrogenous foods (the proteids) and converts them into peptones. In this way it may be said to finish up the work of the stomach.

The intestinal juice.—The action of the intestinal juice is not so thoroughly understood, but it is supposed to resemble that of the pancreatic juice and to affect all substances in the intestines which have not been acted upon by the other juices. It does, as one might say, the final clearing-up.

The bile.—The bile secreted by the liver, has several important uses. Like the pancreatic juice, it is poured into the top end of the small intestine. It helps to moisten the mucous membrane of the intestine, and renders it more favourable to osmosis and the absorption of fats. In conjunction with the pancreatic juice, it deals with fats. We have seen that the saliva of the mouth has no effect upon fats, and that the gastric juice merely separates the fats from their nitrogenous coverings. We know that fat will not mix with water, and will not, in any ordinary circumstance, pass through a membrane. The bile and the pancreatic juice, acting together, come to the rescue by emulsifying fats and thus rendering them fit for absorption. This process of emulsification needs a word or two of comment.

The emulsion of fats.—If melted fat or oil be poured into a vessel containing warm water, the two liquids will not mix. But if the vessel be vigorously shaken, the oil, or fat, will be split up into globules. These will be seen scattered through the water. Unless the shaking be continued, however, the globules will soon unite once more and the oil and water will again

form two separate layers. But if, instead of pure water, a mixture of alkali (potash or soda) and water be used, quite a different result will be observed. On shaking the mixture, a milky fluid will be formed. This fluid is termed an emulsion. In an emulsion the globules of fat have been separated by the alkali into such extremely small particles that they remain diffused throughout the liquid. Emulsions of cod-liver and other oils have probably been seen by most people.

So, then, the bile and the pancreatic juice, slightly alkaline as they both are, jointly emulsify and saponify the fats we eat, reducing them to a condition in which they can pass through the mucous membrane of the intestine on their way to the blood-stream.

Another important function of the liver; glycogen.—Another important function of the liver is the formation of a substance known as glycogen. The liver forms this substance, which somewhat resembles starch, out of the blood, and stores it up. When animal ferments get into the blood, this glycogen tends to change into sugar; in this form it is known as glucose, or "liver sugar," and in the earlier form it is also known as "animal starch." Glycogen is not soluble: but the cells of the liver are endowed with the power to extract, from the blood, a fluid which acts somewhat as a ferment; this fluid converts the glycogen into glucose, which is soluble, and in that form it passes into the blood. If the liver be taken from an animal *at once* after it is killed, and thrown into boiling water, the water soon assumes a milky appearance. This is caused by something which has passed from the liver, and this substance can be

extracted; as said, it resembles starch. Add a little saliva, and this starchy substance is changed into something which resembles sugar. The fact that in this state it passes into the blood becomes of great importance in those diseases which are aggravated by the presence of saccharine fermentation, because, as we have just seen, the glycogen is changed into sugar by animal ferments, such as would occur when an undue amount of meat had been eaten before the alimentary canal was properly clear of improper fermentation, and therefore had not been properly assimilated. This is but one of many instances of the need of careful supervision of an exclusive meat diet.

The skin of the intestines and the villi.—The mucous membrane of the intestines is peculiar. It is crowded with glands to a greater extent even than the mucous membrane of the stomach. Furthermore, on its inner surface it is covered with millions of little tongues. These little tongues are observable in tripe. They are called villi. In the first of the following pictures, the villi are seen on the inner surface of the

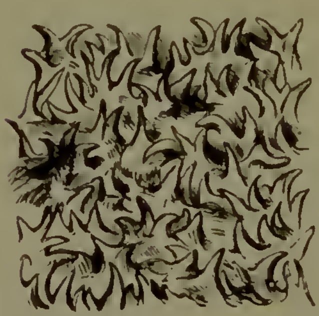

FIG. 17.

FIG. 18.

intestine; in the second a single villus is shown, greatly magnified, and in two different ways. In the right-hand villus is seen a net-work of blood-capillaries, forming a terminal between a small vein and a small artery. These capillaries surround a minute tube, which is shown in the left-hand figure only. This tube is called a lacteal.

Lacteals.—A lacteal does not contain blood; nor is it connected with either a vein or an artery. In it is to be found an almost colourless fluid called lymph or chyle. Lacteals are only to be found in connection with the intestines. Like capillaries, they join together to form larger tubes. These larger tubes unite to form the pouch or receptacle for the chyle, which is poured into the blood by the thoracic duct.

Lymphatics.—There are lymphatic capillaries, lymphatic vessels, and lymphatic trunks. They do not spring up in the form of intestinal lacteals only, for in the organs and tissues of nearly every part of the body, in the spaces between the various structures, innumerable lymphatic capillaries have their origin. These capillaries grow into vessels; the vessels lead into one of two lymphatic trunks.

The thoracic duct.—The larger of these trunks is the thoracic duct, which unites with one of the great veins of the neck, into which vein the thoracic duct pours its contents. The smaller trunk is called the right lymphatic duct. It enters a vein on the right side of the neck.

Peculiar office of lymphatics.—The Lymphatics, which do not originate as intestinal lacteals, have a rather peculiar office. One may say that they collect

the crumbs that have fallen from the rich man's table, and pass the result into the general circulation of the organism. To be more precise, the lymphatic capillaries collect the liquid part of the blood which makes its way through the walls of the blood vessels; they also collect matters which have become separated from the tissues but which have not degenerated, in the process, into mere refuse. The substances thus collected undergo a process of reorganization in some glands which are situated here and there along the course of the lymphatic vessels. The reorganized product is poured into the blood as a valuable nutriment. So the "tailings," or sweepings, of certain industries have a recognized value, are collected and again utilised.

Nature never wastes.—Here we have an example of the fact that Nature never wastes what she produces. And apart from this complete utilisation of products as yet unconsumed, we shall see further on that the mere removal of this overflow is vitally important for the healthy working of the organism.

The thoracic duct, the lacteals and the lymphatics are shown in the diagram on p. 85.

The digestion of fats.—We should now return to the fats, which we have seen emulsified by the bile and the pancreatic juice in the intestines. The milky substance thus formed passes through the mucous membrane of the intestine (a membrane formed of but one layer of cells) into the lacteals. When digestion is going on, the fluid in the lacteals is found to be white and milky, instead of being colourless and clear as lymph usually is. This indicates, of course, the

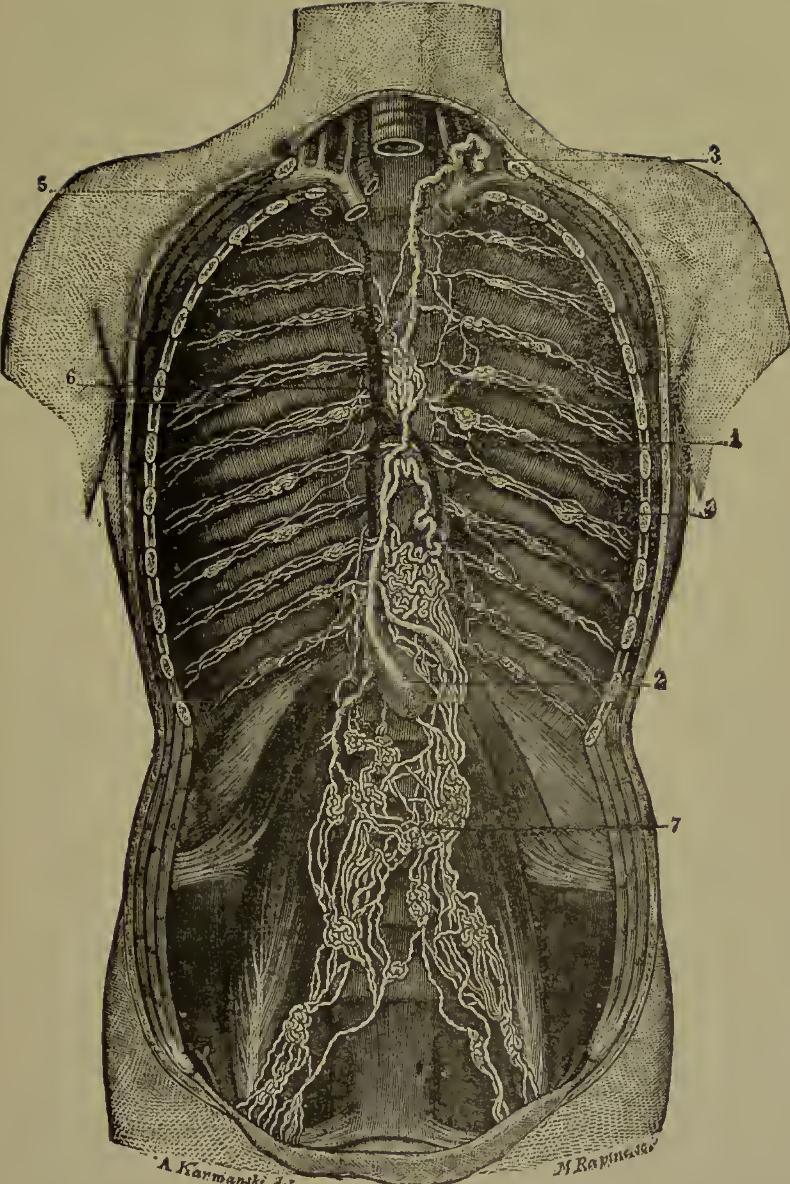

FIG. 19.

presence of emulsified fats. From the lacteals, these emulsified fats pass into the lymphatic system, and so into the thoracic duct. Through this duct they pass into the veins of the neck, into the right side of the heart, then through the capillaries of the lungs into the left side of the heart, and from there into the general circulation.*

Solubility of salts and minerals.—As the salts and minerals are soluble in water, they can pass through the membrane of the alimentary canal at almost any point, and thus directly into the blood capillaries. This passage of the salts and minerals through the membrane may be made in the mouth, in the stomach or in the intestines. The result is the same. Water can also pass into the blood at almost any point along the canal.

Balance of the organism.—We have now seen what becomes of the fats which we eat; what becomes of the starches and sugars; what becomes of the proteids. We see how delicate is the balance between all these processes and affinities.

Distribution of work.—How fine is the distribution of work, and how often it must be disturbed by man! Not an organ of the body, not a juice, not any

* NOTE.—The results of improper fermentation, as opposed to digestion proper, will be considered in a later chapter, but it will be well to note here that the fats undergo butyric fermentation (and we have to remember that this includes the fat contained in meat, bacon, milk, butter, cream, yolk of egg—"harmless dairy produce"); the products of this fermentation, together with the properly digested fats, pass directly through the lacteals and the thoracic duct into the blood, and so through the right side of the heart into the lungs without having been passed through the "filter-bed" of the liver. This anatomical point will be further referred to, but its importance is emphasized here.

part of the system that will do properly any but its appointed task, or seize upon any but its appointed food in the normal state of the healthy organism.

Man perverts or readjusts.—It is given to man to pervert this beautiful adjustment at will. It is also given to Nature to struggle against the errors of man in this respect and to claim his aid in readjustment; and surely she does not leave him without multiple warnings that he is violating her laws as she herself dares not do.

How a piece of meat becomes blood.—Shall we now try to trace this "becoming" of meat, this wonderful conversion into blood? Suppose, then, that we eat a piece of meat. It is first masticated by the teeth and made soft and moist by the saliva. From the mouth it passes down the gullet into the stomach, where the gastric juice lies in wait for it. The proteids in the meat are *quickly* dissolved by the gastric juice (provided it has been thoroughly broken up and mixed with saliva), which juice also separates the fat in the meat from all nitrogenous coverings, stripping it in readiness for the work of the bile at the next stage. In this way a pulpy mass is formed, with the fat, now melted by the heat of the stomach, floating on the top. This pulpy mass is rolled about the stomach for some three or four hours, owing to the contraction of the muscles surrounding the walls of the stomach.

Meanwhile a great part of the dissolved proteid substance, either in the form of peptones or as soluble albumen, passes through the mucous membrane of the stomach into the blood capillaries and so, by the

portal vein and liver, into the stream of the circulation. The remainder of the proteids, with the melted fat, at last passes through a "valve" between the stomach and the beginning of the intestine. So soon as this self-acting door has let it through, the bile and the pancreatic juice spring upon the fat and begin their turn of work. Undigested proteid matter, emulsified fat, the useless parts of the meat, with salts and water, together form a thick, yellowish cream, under which form they collectively receive the name of chyle. (Chyme is its name before the fat has been emulsified.) The muscles of the intestine keep up a constant worm-like motion throughout their entire length. This worm-like motion gradually forces the chyle along the intestines. Throughout its passage the emulsified fat in the chyle is licked up by the villi-tongues, and slips through their thin walls into the lacteals. The proteids left over from the stomach and further acted upon by the pancreas, are taken up by the blood vessels, and perhaps by the lacteals. Nothing at last remains but refuse—parts of the food that cannot be digested, with other parts that have escaped digestion for one or another reason. This refuse is then thrown out at the end of the canal as useless. The marvel is accomplished: the meat has passed into and is on the way to become blood!

CHAPTER VII.

THE DISPOSAL OF REFUSE.

Have my readers ever seen what is called the "ore dump" of a gold or silver mine, or the slag-heap of an iron furnace? It is a heap of waste matters, which, after all the precious ore has been extracted, is thrown outside the mine as useless. In the same way, the body casts aside its refuse, and it does this in more than one way. When it has converted all the food into blood, there is more than one kind of waste product left over, of which the body must rid itself.

Excretion: more than one kind.—Will it, then, surprise my readers to hear that there is more than one kind of excretion, and more than one kind of refuse to be cast aside by the body? For this is quite true. We have learned how it is that the food we eat becomes blood. We have seen how the body feeds upon the blood. But we have not yet seen how the blood gets rid of its refuse. For while the blood feeds the various parts of the body, enabling these to burn, it also carries away from those parts the refuse resulting from the burning.

Combustion and its ashes.—When we consider the nature of albumen, (see p. 74), we find that, when

burned, it is converted into water, carbonic acid and ammonia. We also know that before it was burned it must have contained carbon to form the carbonic acid, hydrogen to form the water, and nitrogen to form the ammonia. On burning blood as a whole, however, it is found to leave a residue of ash, as well as carbonic acid, water and ammonia. The fact is, that the body as a whole, when burned, is invariably converted into carbonic acid, water, ammonia and ash. And this is true, whether the body be burned after death in a furnace, or whether it be burned while in life with the help of the arterial (oxygenated) blood. The result of the burning, of the *oxidization*, is the same. For the chemical elements of which the body is built up, the nitrogen, carbon, hydrogen, oxygen, sulphur, phosphorus and other elements, form various products after oxidization, and indeed as its result. Water is formed from the hydrogen and the oxygen of combustion; from the nitrogen and hydrogen, ammonia is formed; carbonic acid is formed from the carbon; and ash (phosphates, sulphates and other salts) from the phosphorus, sulphur, iron and so forth.

These are the things of which the body must get rid if it is not to be choked by its own refuse.

We have already seen how the body disposes of undigested and indigestible food-stuffs, by direct excretion from the alimentary canal by way of the bowels; but we are now dealing with another aspect of excretion—with the excretion, or casting off, by the body, of the refuse left over from combustion.

Matters to be excreted.—There is the carbonic acid in the first place. It must be got rid of. We know that a great deal of it passes out in the air we exhale. Some of it passes out through the sweat-glands, with the perspiration ; also, some of it departs by the bowel, if there be an excess of it and no other way can be found.

Excretion by the lungs.—Then there is water. Water also passes out in the breath, for no matter how dry the inhaled air may be, that which is exhaled is always full of moisture.

Excretion by the breath.—To prove this, one only need breathe on some dry, cold surface and notice the deposit of water which is immediately formed.

Excretion by the sweat-glands.—And a great deal of water passes off through the sweat-glands, for perspiration consists chiefly of water. Nor does it follow that beads of perspiration should form : a healthy skin is always giving off invisible vapour.

Weight of the perspiration.—The invisibility of this vapour by no means implies that it is without weight, for the weight of the perspiration, thus invisibly excreted during the twenty-four hours of the day, has been estimated at about two pounds. In the perspiration, besides carbonic acid, there are various dissolved salts.

Water, salts and ammonia.—We have thus far accounted for the carbonic acid, some few saline matters and part of the water. It still remains to be seen how the blood rids itself of the rest of the water, of the salts, and above all of the ammonia. These are disposed of by the kidneys and the liver.

Excretion by the kidneys.—There are two kidneys. They are situated behind the intestines, one on each side of the spinal column, at the top of the haunch-bone. The bottom of the liver reaches to the right kidney; the spleen reaches to the left.

Ureters.—Two tubes, known as ureters, pass downwards from the kidneys. These tubes are about fifteen inches in length.

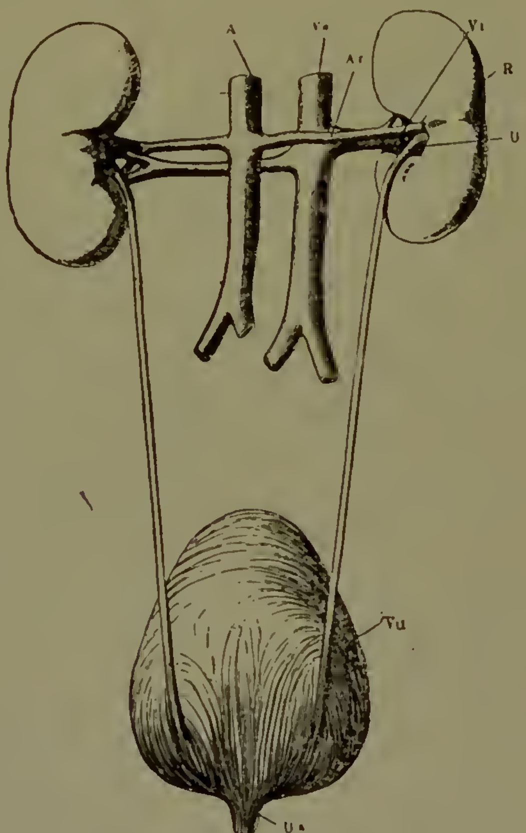

FIG. 20.

The bladder.—They lead to a receptacle or bag, called the bladder.

What a kidney is.—A kidney is a bundle of glands bound together, and covered with a thin fibrous coat. These glands secrete from the blood a liquid known as urine. The blood passes into the kidneys by way of small arteries leading from one of the great arteries.

Secretion of urine from blood.—From this blood, urine is secreted in much the same way as perspiration is secreted by the sweat-glands. The blood, *minus* that part of it which has been retained by the kidney, then passes from the kidney into a great vein, by way of two smaller veins. The urine which has been secreted by the kidneys then passes down by way of the ureters into the bladder. From the bladder, by another duct, it can be passed out of the body.

Chemical composition of urine.—The urine consists chiefly of water. Certain salts are dissolved in this water. It also contains a quantity of ammonia. The ammonia is not in a pure state, being mixed with carbonic acid. This mixture of ammonia and carbonic acid is known as urea.

Uric acid: its chemical composition.—Mixed with the water of the urine there is another substance besides the dissolved salts and the urea. This substance is uric acid. Like urea, it is nitrogenous in character, being derived, in part, from the ammonia arising from the oxidization of nitrogen.

Excretion by the liver.—The liver purifies the blood by separating from it various injurious matters in order to throw them out of the body. It elaborates in its cells the fluid called bile. Bile consists of 84

per cent. of water and about 14 per cent. of solid matter. This solid matter may be separated by chemical process into: bile salts, fat, colouring matter, chloride of sodium (common salt), phosphates, traces of iron, and a peculiar crystallised substance called cholesterine.

Of these, the bile salts are the secretion which is used to emulsify the fats, as already stated. They appear to be again absorbed with the dissolved fats, and again secreted. The rest of the material is mainly to be excreted or expelled from the system.

Thus the liver disposes of any excess of carbon and hydrogen in the blood, by extracting these elements from the blood and passing them into the intestine with the bile.

Summary.—So we see that:—

(1) *The skin disposes of a great deal of water and of some carbonic acid and salts.*

(2) *The lungs dispose of a quantity of carbonic acid and of some water.*

(3) *The kidneys dispose of a quantity of water and of ammonia, with carbonic acid and some salts.*

(4) *The liver disposes of any excess of carbon and hydrogen and of the colouring matter of the broken down blood. It also throws back into the intestine, materials absorbed with the digesting food which would be harmful if passed directly into the circulation.*

Disposal of refuse by the blood.—We have now seen how the blood gets rid of all the refuse which

it carries away from the muscles, the bones, the brain, the nerves, the skin and all the other parts of the body to which it carries their food and to which it takes the oxygen with which the food is burned. Think how much depends upon the blood: it gives our muscles the power to move; it gives our nerves the power to feel; it gives our brain the power to think. Out of it all the glands of the body secrete their juices—juices which are vitally necessary if life is to be maintained.

Warmth and work.—And by means of the oxidization which it makes possible, our bodies are kept warm and we are enabled to labour.

CHAPTER VIII.

HOW A HEALTHY MAN MAY EAT AND DRINK.

What we have learned.—We have now very briefly surveyed the structure and functions of the human body. We know the main lines of the mechanism with which we have to deal in daily life; something of the way in which we are constantly remaking our bodies, and of the way in which everything we eat and drink, every breath of air we breathe, every movement we make, and to some extent, every thought we think, tends to promote or disturb the delicate equilibrium which we call health. We may now briefly consider the best means of preserving that health.

Some general propositions.—From what has been said already, the following should be clear :—

The human body needs proper food, proper air, proper movement and proper cleansing.

What is proper in these points in health, may not be proper in disease. What is proper in disease may not be proper in health. And what is suited to one organisation, in either condition, may, most emphati-

cally, not be suited to another in a similar condition. This seems a simple and common-sense proposition, and yet it is continually violated. There are people who imagine that because some particular diet, for instance, has helped them to recover from an illness, it must follow that the same diet will agree with them in health; or, that it must agree with some other person who is stricken with the same illness. They go so far, occasionally, as to suppose that all their relatives and friends should adopt this diet; which is sometimes unpleasant for the friends, besides being quite unreasonable.

Normal health and normal food.—An organism in a normal condition requires normal feeding; an organism in an abnormal condition may and does require abnormal feeding. As we are still dealing in these pages with the human organism when functioning normally, we can, for the present, confine our attention to normal feeding.

Ideal dietaries a practical error: why?—If patients are sometimes inclined to overlook the fact that what is proper in disease may not be proper in health, an equally foolish mistake is sometimes made by persons who indulge in quasi-scientific theorizing but who lack that sort of experience without which theories, however scientific, are worse than useless. After estimating the body's daily loss of nitrogen, carbon and so forth, such persons will construct "ideal" dietaries, giving the chemical constituents of the foods they recommend, and showing that these chemical constituents will almost exactly replace the natural loss.

The digestibility of foods.—But how about the digestibility of these "ideal" foods?

The digestibility of a food, not only in general but in relation to the idiosyncrasies of each organism, should receive at least as much attention as the chemical constituents of that food.

Chemical make-up not the sole factor.—This is the highly important fact which the pseudo-scientist overlooks. He will demonstrate that so many ounces of dried codfish contain as much nitrogen as is daily used up by the body. Dried codfish will therefore serve to supply the amount of proteid matter which the body needs. It is cheaper than beef-steak! Or it may be demonstrated that quantities of beans and lentils contain enough proteid matter to replace the nitrogenous waste. As against this theorizing one may well put experience, and a proper scientific study of *the after effects of foods.*

The after effects of foods.—And the fact is that dried codfish, if taken frequently, is positively dangerous to many people in its indigestibility; and that beans and lentils, if relied upon exclusively to supply the amount of proteids needed by the body, will, in many cases, produce serious chronic disturbance, owing to the inability of any but exceptional organisms to dispose properly of the coverings in which the proteids of beans and so forth are wrapped up.

Each man a law to himself.—The fact is that physiologically, as in other ways, each man is a law unto himself, and to attempt to lay down absolute

rules of conduct for the preservation of health, would merely show an ignorance of human nature and of the essential characteristics of the human organism.

The human type is one thing; the individual is another. The type has certain broad general characteristics; the individual has special modifications. Until the individual is trained to proceed on the normal lines of his type, his specific deviations from the rule of that type, must be given due weight.

One can at best give facts, make general suggestions, and then leave the individual, in the light of his own experience, to draw deductions applicable to his own case. Of course, after personal examination, far more than this can be done. I am now speaking only of the advice which it is possible to give in books.

Proper food in health.—The question, then, is this: what foods should be taken by a man or woman in good average health?

Elements to be replaced in the body.—We have seen that two-thirds of the body consist of water; that the rest of the body is made up of nitrogen, carbon, hydrogen, oxygen, sulphur, phosphorus, iron, calcium, sodium, potassium, magnesium, chlorine, and one or two other elements. All of these elements, and the water as well, are constantly passing off from the body. The water, and these various elements, must be replaced if the health (weight, heat and so forth) of the body is to be maintained.

Water.—Let us consider the water first. It is frequently considered last. Sometimes it is not

considered at all. Yet life may be maintained on water alone for days and days at a time (the experiments of Dr. Tanner and other "fasting men" proved that if they proved nothing else). And without water in some form, no amount of dry proteid or other substances could maintain life for more than a very few days: one might almost reckon it in hours.

Not only do two-thirds of the body consist of water, but the average body is said to excrete some six pounds of water during the twenty-four hours. A certain proportion of the water excreted is the product of the oxidization constantly taking place in the body, but the larger part of it has to be replaced by the taking in of liquid in some form or another as food. From three to four pints of liquid should be taken in this way.

Three to four pints will prove by no means too much. The inside of the body needs to be kept moist; then, too, water is needed for the dissolving of the solid foods (we have seen that food cannot pass into the blood except it be dissolved or suspended in water); and finally, water is needed to wash away the refuse matters, which, without this internal cleansing, would accumulate and choke up the system. Pure water is the best possible form in which liquid can be taken. Wines, beers and spirits can be useful as medicine, but as a general rule it is better not to take them habitually. Here, however, circumstances sometimes introduce exceptions to the general rule; though, while granting that it may also be said that a good many people who think their pint, or more, of wine to be absolutely necessary to their daily existence, would

get along and feel much better in the end without it. If such people need stimulants, they can obtain them, and without the disagreeable after effects so frequently left by wine.

Hot water a stimulant and cleansing agent.—One of the simplest forms of stimulant, and one of the most effective, is a cup of hot water. A cup of hot water will stimulate and give tone to all the bodily functions. Two cups are better still. This will leave no "aftermath of sorrow"—as wine sometimes will, if only in the form of acidity of the stomach; and there is much less reaction after the stimulation by hot water.

Hot water, in nearly all cases, is preferable, as a beverage, to cold water. Cold water, unless taken in sips, is liable to chill the stomach. Drinking less at meals, but taking a pint of hot water not less than an hour before breakfast, and another pint the last thing at night, will do wonders toward keeping the body in health. It is satisfactory to find that the more prominent authorities are rapidly adopting this view.*

As Sir T. Lauder Brunton says: "By giving the hot water on an empty stomach you do good to the liver without damaging the stomach." It is a rare preventative of trouble. As a curative agent it will receive attention later.

Less alcohol and more water; less liquid at meals and more when the stomach is empty; these are probably the best general suggestions that can be made in regard to drinking by people in normal

* See Lectures on the *Action of Medicines*, p. 475, by Sir T. Lauder Brunton, M.D., D.Sc., F.R.S., Physician and Lecturer on Pharmacology and Therapeutics to St. Bartholomew's Hospital.

health. Tea or coffee, if taken in moderation, and if properly prepared, will not harm a healthy body. To take either of them in excess will of course prove injurious. But if there be one absolute rule in *dietetics*, it is that to take anything in excess is injurious. Moderation in all things can alone prevent disturbance and consequent ill-health.

A suggestion.—This applies to eating quite as much as to drinking. In most cases, people have a fairly good idea of what they should and should not eat. They often indulge themselves deliberately. But, if they take themselves in hand and determine to eat to live, not to live to eat, they will probably eat the right thing. Self-restraint is necessary, but it brings its own reward. Dr. Keith struck the right note in his *Plea for a Simpler Life*, and experience proved its value to many of his patients. Too much indulgence in the pleasures of the palate produces well-known ill-effects. Indeed, it may almost be said that too much mixture of food is as bad for man as too much mixture of liquors.

Eat to live and not live to eat.—Almost all people eat too much. And, as another general suggestion, most people eat too much starch (as in bread, potatoes, rice, pastry and cakes), and too much sugar.

Apart from water, the human body is composed chiefly of nitrogenous (proteid) substances. As these, with the carboniferous and other matters, are constantly being given off from the body, they have to be replaced by food.

Milk.—There is one food that will replace all that the body loses, and all that it requires for its replenishment. That food is milk. Life could be

maintained for years on milk alone. But the quantity taken in the case of an active adult, would need to be very large. At least nine pints a day would be required. These would best be drunk in sips; or, better still, sucked in slowly through a straw; so that the greater part of the day would be occupied in nourishing the body. This sounds an extreme statement. It might not take more time than our meals do now as a whole. But the number of meals would become very inconvenient to the busy man or woman, as will be seen later.

The digestion of milk.—The process of digesting milk is peculiar. The gastric juice coagulates milk. The clots thus formed in the stomach are afterwards dissolved, and that part of the milk which is nitrogenous in character is then converted into a form of peptone, and in that form is absorbed directly through the walls of the stomach. After the dissolution of the clots, the other parts (the fats, sugars and salts), are digested in the ordinary way, with the help of the intestinal juices and the bile and pancreatic juice.

But the dissolution of these clots is no easy matter. When large they lay very heavily on the stomach. Hence few people can drink milk in large quantity with impunity. Sucking it through a straw—imitating in this way the method of nature in the feeding of the young—has the effect of making the curds exceedingly small and numerous, so that the gastric juice has a larger surface on which to act. In this way, instead of having to dissolve a large compact mass, it can deal with separate and finely divided flakes. The large clots or curds produce a

similar result to that caused by bolting the food without any mastication. But even if the milk could be made digestible, who would care to spend several hours a day sucking at nine pints of liquid? It would be an extravagant diet also, in the sense that an equal amount of nutritive matter can be taken in a more concentrated and more easily digested form, involving less effort on the part of the various digestive organs.

The composition of milk.—The proportions of the nutritive matters of which milk is composed have been given as follows:—

Cows' milk	87.42	3.41	3.65	4.81	.71
Human milk.	87.02	2.36	3.94	6.23	.45
	Water.	Proteid matter.	Fat.	Carbo-hydrates.	Food Salts.

The "Food Salts" have been stated to have the following percentage composition:—

	Cows' Milk.	Human Milk.
Potash	24.67 ...	32.79
Soda	9.70 ...	9.12
Lime	22.05 ...	16.69
Magnesia ...	3.05 ...	2.16
Oxide of iron ...	.53 ...	.22
Phosphoric acid ...	25.48 ...	20.66
Sulphuric acid ...	.20 ...	.95
Silicic acid ...	.04 ...	.02
Chlorine ...	14.28 ...	17.39

The advantages of a mixed diet.—It is in about those proportions that the various "families" of "food-stuffs" should be taken in health. A mixed diet will supply what is wanted in the most concentrated and in the most easily digested form. Meat will then form the basis for the proteid matter which is needed, as well as supplying a good deal of the fat (Hydro-carbon). Butter will supply more fat. Bread, potatoes and sugar, with various forms of cakes and puddings, will *more* than make up the necessary proportion of the Carbo-hydrates.

Leaf vegetables and fruit.—Green leaf-vegetables, such as spinach, cabbage, cauliflower, Brussels sprouts and lettuce, besides contributing their quota of proteid and carboniferous matter, together with a considerable amount of water, supply the important food-salts which have been tabulated above. The fruits also supply these food-salts, apples and strawberries being particularly rich in soda; plums and cherries in potash.

Proteid matter and life.—We have seen already (p. 75 *et seq.*) how these different food-stuffs are dealt with in the human organism; how the food becomes blood and how the blood burns and promotes the burning of the rest of the body. Among the foods the proteids play an essential part in the formation and repair of the tissues and juices; the carboniferous foods supply material for burning and thus assist in maintaining the heat of the body; the salts purify the blood and enable it to perform its various functions. The proteids are the essential element in food, for they can supply everything that

the body actually requires. Life can be maintained on proteid matter (and water) alone. This is not true of any other food, whether of the Hydro-carbons, Carbo-hydrates or Salts.

Proteid matter and waste.—But in ordinary circumstances, an exclusive diet of proteid matter is wasteful, because unusually large quantities have to be consumed in order to make up for the absence of the more concentrated forms of carbon. This throws an additional burden upon the stomach which, *unless there are special reasons for wishing to rest the liver and the intestines*, is a burden it is better to distribute evenly among the various organs of the alimentary canal. Hence, in health a mixed diet is best.

A word of advice.—But again let me advise less food of all kinds, and particularly less sugar and starch, whether in the form of bread, potatoes, cakes or pastry.

CHAPTER IX.

THE VENTILATION AND CLEANSING OF THE HUMAN HABITATION.

Proper air in health.—We know that the blood feeds on air quite as much as on the more solid foods. Without oxygen, combustion is impossible. Many people who take proper food, are made ill by the lack of pure air. In the course of twelve hours, about two hundred cubic feet of air are passed into the lungs of a man taking very little exercise, and the air thus breathed is charged with about five per cent. of extra carbonic acid and is deprived of about five per cent. of its oxygen.

Impure air.—When the air of a room contains more than six parts of carbonic acid in every ten thousand parts, the air is impure and should be renewed.

Quantity of air per man in health.—Three thousand cubic feet of air per hour is the quantity used by a man in health. Six thousand cubic feet per hour is the quantity used by an ordinary No. 3 coal-gas burner. That is to say, if the air in a room were not renewed, and if two people were to sleep in it for eight hours, burning two gas burners for two hours

out of the eight, the room would have to measure 72 feet by 50 feet and be 20 feet high, to supply the occupants with sufficient pure air. Rooms of this size are scarce, and yet how many people sleep with closed doors and windows!

Some impurities in air.—Perhaps they do not know that in addition to the carbonic acid given off by the breath, many of the bowel gases are absorbed by the blood-vessels of the bowels and are excreted through the lungs. To breathe air already exhaled is both unhealthy and unclean.

Ventilation: caution in its use.—Suddenly to open one's windows at night after sleeping with them closed for many years would almost certainly mean a bad cold in the morning. No sudden change of the kind would be wise. Furthermore, when making the change it is best to put extra coverings on the bed and to keep a fire burning all night. Then begin opening the windows, one half inch more every night. Those who have never tried it will be astonished at the improvement in their health. They will wake up refreshed, instead of more tired than when they went to bed. And they will feel warmer than usual, for the plentiful supply of oxygen will have enabled combustion to take place unimpeded, so that their bodies will glow with the natural heat of their own burning.

How to ventilate a room safely.—One good method of ventilating a room and of avoiding a direct rush of cold air into it, is to raise the lower window sash about five or six inches, and to fill in the space with a piece of wood fitting exactly into the frame of the window. No air will come in there, but a narrow

space will be left between the upper and the lower window sashes. Through that narrow opening the air from outside will pass into the room and *upwards towards the ceiling.* The bad air will then escape up the chimney and will be replaced gradually and without sudden shock to those breathing it, by the pure air at the top of the room.

Of course, pure air is quite as much needed during the day time as at night, but, fortunately for the people concerned, it is usually more difficult to shut out fresh air then than during the undisturbed hours of sleep.

As a general suggestion : do not sit in draughts, but do not be afraid of pure air, for without it no one can live healthily. If windows prove too much, open all the doors ; but whatever means you adopt, be sure to breathe fresh air, plenty of it, constantly renewed.

Proper exercise in health. — Exercise of the lungs. — This leads us directly to the question of proper movement or exercise. All parts of the body need movement, but no part more than the lungs. The air in the lungs should be changed continually.

Tidal and stationary air : deep breathing.—We have noticed the difference between "tidal air" and "stationary air." The stationary air should, so far as possible, be changed by deep breathing. This deep breathing may be brought about by quick walking, by riding, or by other forms of exercise. Singing will bring it about to certain extent. But however caused, the important thing is that the air in the lungs should be changed. This cannot be done satisfactorily by means of ordinary breathing, which affects only the surface air in the lungs. Those who lead sedentary

lives would do well, therefore, to inhale and exhale slowly and deeply near an open window, when they first rise in the morning. It will wake them up as nothing else will, for by this means they will get rid of the superabundance of carbonic acid which has accumulated in their lungs during the night.

Carbonic acid a nerve poison.—Carbonic acid being a nerve poisoner, deadening and paralysing the nerves of the brain, is largely responsible for the heaviness and lassitude which trouble so many people on first awakening. The influence of this is seen in cases of Inflammation of the Lungs and in Bronchitis, where the surfaces by which oxygen enters the blood are reduced. Here the inhalation of pure oxygen has proved of the utmost value and its use has rescued many otherwise hopeless cases.

Deep breathing, and the thorough oxygenization of the blood which results from it, will almost take the place of more active exercise; but not quite. Though proper breathing exercises some of the muscles of the chest and abdomen, it does not move the muscles of the arms or legs: nor does it affect the joints.

Muscles and joints need exercise.—Our brief physiological sketch should have made it plain that all the muscles and joints need exercise.

Clogging of the system.—Without exercise, the muscles and joints, and the nerves which permeate them, cannot possibly be nourished by the blood. Nor can the refuse from their combustion be removed. There is nothing especial to draw the blood to those parts of the body which remain inactive. There is nothing—or still less—to assist in driving it away.

Hence the whole system, in such circumstances, becomes gradually clogged—joints, muscles, nerves, liver, bowels, brain.

Muscular exercise at home.—Consequently, those who cannot get out-of-door exercise of a kind that will bring all their muscles into play, should make a point, before dressing in the morning, of adding muscular exercises to their regular breathing exercises. They will find dumb-bells, or Indian clubs, or the "Whiteley," "Sandow," and other exercisers, of considerable assistance to them ; but none of these are necessary, and proper movements will alone accomplish all that the maintenance of health requires.

Women and men alike.—It would be erroneous to suppose, as some would seem to do, that only men need exercise. All that has been said above, applies quite as much to women as to men. The proof of this is seen in the improved health given to women by the exercise obtained in lawn-tennis, cycling, fencing, gymnastics, riding and so forth, *provided that these are not overdone*, as is too often the case. Therefore, *proper* exercise must be determined upon and maintained.

The proper cleansing of the outer skin.—Lastly we come to what I rather crudely described as proper cleansing, which is as necessary to health as proper food, proper air or proper movement. The air, the teeth and the skin require constant cleansing. We have seen that through the skin many of the impurities of the body are excreted—surplus water, surplus salts, and a certain amount of carbonic acid. If the pores of the skin are not kept open, that much

extra work is thrown upon the kidneys ; the kidneys cannot be overworked with impunity. Everyone knows the tale of the child whose body was covered with gold-leaf for the purposes of show, and who died as a direct result of this choking up of the pores. It is not only the excretions from the sweat-glands that need removal by washing, for, in the first place, innumerable dead scales of skin are constantly being cast off ; and in the second place, wherever there is hair on the body, will be found the excretion of the oil-glands, which, in the case of persons with greasy skins, exude an immense amount of oily matter. The perspiration, the dead scales of skin, the oily matter from the roots of the hair, "rubbings" from the clothing, and the dust of the air (consisting of mineral and animal matters), combine to form an imperceptible cake (in some cases a very perceptible one), of dirt which clogs the pores as effectually as gold-leaf, if the skin be not frequently and thoroughly washed.

Rubbing and soap.—Hard rubbing with a rough towel is better than nothing, but soap is needed to remove the oil, because soap contains alkaline substances, and these, set free by the water, make the grease soluble and removable.

Bathing.—In health, a warm bath before going to bed will hurt no one. A cold plunge bath is not so cleansing, although, for those whose circulation can quickly react from the sudden driving of the blood from the surface to the inner parts of the body, a cold plunge bath on rising in the morning is a useful tonic and stimulant. It should be discontinued, however,

on the first approach of unhealthy conditions in any part of the body, for the lowered vitality of the temporarily diseased member will hinder the reaction of the blood back from that member to the skin, and congestion may result.

Hot baths promote bodily activity.—A hot bath, at a temperature of about 103° F., is quite as stimulating as a cold bath : it should be followed by a douche of cold water given with the sponge or otherwise, just before quitting the bath. This promotes the activity of all the bodily functions.

Proper cleansing of the inner skin.—The inner skin of the alimentary canal, the pores or glands of which, it will be remembered, open inwards, instead of outwards as on the surface skin,—the inner skin requires washing as much as the outer skin. This fact is very frequently overlooked, even by those who make an especial study of hygiene. As in the case of the outer skin, warm water (not merely tepid), is the best means by which this cleansing can be effected.

Hot water and mucous membrane.—Under the head of "Proper Food," and of Water as one of the chief foods, I have already suggested the value of hot water as a purifier of the blood and as a remover of waste matters. It has a direct effect upon the skin, or mucous membrane, of the alimentary canal. The pint taken an hour before breakfast, and that taken the last thing at night, will cleanse and at the same time will stimulate the inner skin, and will prevent any clogging of the gland openings.

Soda and hot water.—But, for exactly the same

reason that soap is used when washing the surface of the body, it is well, once a week or oftener, to add some alkaline matter, such as soda, to the hot water. The alkali will neutralize any over-acidity of the stomach or intestines, will render any greasy matter soluble, and will generally assist the hot water to complete its work. A teaspoonful of Phosphate of Soda, taken once a week in a cup of hot water, will help the healthy to maintain their health, by cleansing the whole course of the alimentary system.

Cleansing the hair and the teeth.—What applies to the skin, applies to the hair, which may carry with it germs of innumerable diseases unless it be frequently and thoroughly cleansed. And foul and decayed teeth, by reason of the putridity they shelter, and which they give off during the mastication of food, may make digestion almost impossible. It is not sufficient to wash the teeth night and morning. No amount of washing will remove decay, once decay has begun. Decay is a life process: that is to say, it is carried on by living organisms, microscopic, but none the less destructive. Their activity is poisonous, and it poisons whatever it reaches. Food may be poisoned in this way before it reaches the stomach. So, unpleasant as the remedy may prove, there is no way of escape but the way to the dentist. He will clean your teeth as you cannot clean them, and by so doing will enable you to preserve the health which, if you are wise, you will value as a possession cheaply paid for at the cost of a few moments' pain.

CHAPTER X.

HOW HEALTH MAY BE DISTURBED.

Some causes of chronic ill-health. — Having specified the need for proper food, proper air, proper movement and for proper cleansing, we are now in a position to consider some of the most common causes of chronic ill-health. In most cases, where chronic disease is present, it will be found that the laws governing the maintenance of health have been persistently violated. Minor disorders have resulted and these minor disorders have gradually given rise to a diseased tendency, which tendency finally forms the basis for chronic disease.

Improper food.—Improper food may produce a variety of such disturbances ; and food may be " improper " because of :—

(*a*) Its quality.

(*b*) Its quantity.

(*c*) The way in which it is prepared. Firstly : before it enters the *mouth*, owing to improper preparation and cooking. Secondly : before it enters the *stomach*, owing to improper mastication by the teeth.

(*d*) Its wrong admixture with other foods.

Bad cooking.—The wrappings of some foods.—If food be badly cooked, the non-nutritive coverings in which the particles of meat or grain are wrapped, are not removed or softened. The consequence is that the condition of the food as it enters the stomach, might be compared to gold locked in an iron box—useless unless the holder be sufficiently powerful to force open the box and extract the gold. On the supposition that the stomach is sufficiently powerful to do this with its badly cooked food, still, about twice as much labour is involved in the process of digestion as would otherwise be necessary. Supposing, on the other hand, that the stomach and other organs prove to be unable to remove the wrappings of such food, their labour will have been expended in vain and the body will remain without nourishment. In either case, the organs of the alimentary canal will become exhausted and in time incapable of further activity.

Improper mastication.—Improper mastication, as when the food is bolted; or when mastication fails by reason of decayed teeth; or when the teeth are gone, is a fruitful cause of chronic gastric or intestinal trouble. We have seen that the starch of bread, potatoes, rice and other carbo-hydrates, after the teeth have done their work, should be partly converted into soluble sugar by the action of the saliva.

Overtaxing of intestinal and pancreatic juices.—When food is bolted, that part of it which belongs to the family of Carbo-hydrates passes almost unaltered through the stomach into the intestines, where

the intestinal and pancreatic juices have to deal as best they can with this material, which, in that form, is not a rightful part of their labour. But as these juices have quite enough to do in the first and rightful instance, the result is that a large part of such food remains undigested. Nor does it pass out of the body without working considerable mischief, as will be explained very shortly hereafter.

The organisms of putrefaction.—The danger of decayed teeth has already been referred to. The microscopic organisms which both cause and result from the decay, mixing with the food in the mouth, pass into the stomach and thus give rise to decay and putrefaction there and in the intestines. Putrefaction, caused in this way, produces flatulence and the decomposition of the various food-stuffs, with the formation of poisons, which will be considered under the sub-head of "Ptomaines," (see p. 131).

The effect of food upon the teeth.—While decayed teeth poison our food, food may also poison and destroy our teeth. What has been said of heredity applies here as elsewhere: tendency does not mean necessity. Deficiency of lime in the food of the mother will cause feebleness of bone in the offspring.

Farinaceous foods and food salts.—Then, many of the farinaceous foods, on which so many children are fed now, are almost destitute of food-salts, of lime and iron and soda. They supply little to strengthen the bones and much to promote the decay of the teeth, because the teeth are exposed to the action of the sugar which is contained by these foods in quantities. And it is sugar which does most to decay

the teeth, on account of its liability to rapid decomposition.

Inter-action between foods and the digestive apparatus.—Hence food acts on the teeth, tending to make them healthy or unhealthy, while the teeth react on the food, tending to make that digestible or indigestible. Thus it is with every part of the alimentary canal; its organs are healthy or unhealthy, their condition depending largely upon the foods that have been taken; while the condition of these organs reacts upon the foods, tending to make them digestible or the reverse.

The poisons of improper feeding.—

Once the organs are poisoned by improper feeding, they tend to convert even proper food into poison.

In such instances it is often necessary to give the intestines and the liver as complete a rest as possible, by prescribing a diet that can be dealt with, so far as is possible, by the stomach alone.

The stomach as a relief guard.—The stomach can be used in this way, for the food which it digests—the proteids—can perfectly maintain the strength of the body, provided they are taken in sufficient quantities.

Cleansing of the stomach.—Even while being used, the stomach can be cleansed of impurities more readily than any other part of the alimentary canal, owing to its being possible to reach it directly from without, through the mouth. If, therefore, it should contain the minute organisms, bred by improper feeding, whose action it is that makes food

poisonous, these organisms can be washed out directly by means of a rubber tube, or, by drinking, can be washed into the intestines, and there, with the others already present, may be starved into subjection. Nature will then play the part of scavenger ; and the liver and intestines, thoroughly rested and rid of that which made them incapable of service—even dangerous in their futile effort to serve—will be able once more to perform their task in the economy of the body.

A hint of treatment.—Again, if the stomach itself be at fault, there are times when nutrition may be maintained by pre-digesting the food, and so preparing it that it will be passed into the intestine from the stomach within a very short time after swallowing. The question to be decided is, "which organ requires physiological rest," as nearly as such rest can be secured ?

* * * * * * * * *

We have, in the last paragraph, been going somewhat ahead of our immediate subject, by referring to treatment ; but this has been done in order to convey a preliminary idea of the action and inter-action constantly taking place between food on the one hand and the various organs of the alimentary canal on the other. Now we can consider in detail the abnormal conditions which may be set up in these organs as cause of either activity ; but it may make the two processes, as such, more comprehensible to the general reader. The yeast cells, for example, seize the

nutriment they require. Stimulated by this food, they secrete certain ferments, just as the cells of the stomach, liver and other organs secrete the "juices" of those organs. (And the difference between the secretion of the stomach as a whole and the secretion of one of its cells, is simply the difference between a crowd and an individual). The ferments secreted by the yeast cells break up such substances as they are able to affect and with which they come into contact. These substances, once broken up, supply the means by which the cells are enabled to prolong their existence and to multiply.

On the larger scale, the juices secreted by the organs of the body contain the ferments derived from the cells of those organs. These ferments, acting on the food with which they are mixed by the process of mastication and by the movements of the stomach, break up the food into substances which can be absorbed through the walls of the stomach and intestines, and thus provide the means by which the life of the cells and of the body is prolonged.

It might, therefore, almost be said that nothing is absorbed into the system without previous digestion by lower organisms.

Healthy and unhealthy fermentation.—But fermentation in relation to the human organism may be healthy or unhealthy, normal or abnormal. So far we have dealt with healthy, normal fermentation.

Microbes, some of them, and their work.—There are present in the body innumerable minute organisms, popularly known as "microbes." These microbes, in suitable conditions, will often give rise

to unhealthy fermentation. The bacillus Acidi Lactici, the Mycoderma Aceti, the Saccharomycetes or various forms of yeast are some of them. These cause the fermentation of starchy food or carbohydrates (starch and sugar) and, in some cases, of the milk and fats, when these have been taken in excess and have consequently been detained in the stomach for a longer time than is healthy.

The product of this fermentation is a combination of acetic acid (vinegar), water, carbonic acid gas, alcohol or lactic acid. They irritate the stomach, give rise to flatulence, and if in large quantities they first irritate and then paralyse the secretions and movements of the stomach and bowel. When the irritation apparently passes off, the sufferer thinks that relief has come, but more often it is the subsequent paralysis which is hiding the warning irritation.

Butyric acid fermentation of fat.—The fat of very rich food often undergoes butyric fermentation under the action of the Bacillus Butyricus, and this leads to heartburn and other disorders.

The Sarcina Ventriculi is another organism which is almost invariably found in a dilated stomach, and, besides these, there are many others which possess names but whose functions and actions on food it is not necessary to dwell on.

It must suffice, that in order to live they must have something on which to grow and feed, and this action of the microbes must necessarily be hostile to the human organism by altering the food supplied for its use.

Suitable soil for microbes.—No form of microbe

can exist unless supplied with the soil suitable for its development. This soil is supplied by man as the result of improper feeding. Once it is supplied, and the microbes become active, even the smallest quantity of the food on which they live and their action on which produces fermentation, will have the effect of an active poison on the body, besides perpetuating the existence of the offending microbe. This poison may be almost imperceptible in its effects, but will be none the less actual.

Just as ivy will choke and kill a large tree, these parasites can deprive the body of nourishment and kill it. The foods intended for the support of the body, instead of being converted into substances which nourish it, are converted into substances which feed the extraneous organisms.

Removal by absorption.—The excreta of these organisms is nearly all that remains for assimilation by the body, and as this excrement is poisonous, not only to the body but to the parasites themselves, its removal by absorption naturally does more harm than good.

CHAPTER XI.

BODY AND FOODS AT CLOSE QUARTERS; SOME RESULTS OF THE FRAY.

Foods in the stomach.—We have seen that Carbo-hydrates (starch, sugar, &c.) when taken in excess, often undergo lactic, acetic or alcoholic fermentation, owing to their retention in the stomach.

Prolonged retention of food.—They are retained there because the stomach itself does not digest *these* foods, but merely subdivides and prepares them for digestion; and, the natural tendency of the stomach being to retain food until this is fully prepared for passage into the intestine, it follows that Carbo-hydrates in excess if imperfectly masticated and mixed with saliva, take far too long to churn and to subdivide. In this way, opportunity is given for unhealthy fermentation when microbes are present in the stomach, as they usually are; and unhealthy fermentation, as we have seen, produces flatulence, carbonic acid and other gases, which tend to irritate and then to paralyse the mucous membrane.

What is true of Carbo-hydrates taken in too large quantity and improperly masticated, is true, in part, of

any solid food that is taken similarly. It is retained in the stomach for a longer time than is healthy. This gives an opportunity for fermentation when the nature of the food allows it; and in any case such retention over-tires the stomach, on account of its churning movements being continued so long as food is present. The stomach loses its rest and is rendered quite unfit to deal with the next meal. Like all things in nature, the physical organs proceed upon lines of alternate rest and action, and this law cannot be evaded with impunity in any direction; even in the world of things made by the hand of man the action of this law is seen; the machine constantly used is soon a machine outworn before its time. Physiological rest really contributes to the renewal of the life of the organs quite as much as sleep renews the life and forces of man himself.

Too frequent feeding.—Food taken too frequently produces the same effect of tiring the stomach unduly, and the ultimate result may be chronic constipation, chronic congestion of the liver, or if the food become very irritating, chronic diarrhœa.

Excessive drinking.—Taking too much fluid at meals dilutes the gastric juice, delays digestion in and evacuation by the stomach, and throws additional work upon the intestines. This is liable to produce, among other disorders, chronic dilatation of the stomach, consequent weakening of its motor power, and ultimately exhaustion of all the nerves of the digestive tube, owing to their deprivation of the physiological rest which they require.

Excessively cold food.—Excessively cold food,

such as ice-cream, iced water or wine, is liable to chill the stomach and then to create by reaction an over-secretion of mucus which coats the walls of the stomach, coats thé various boluses of food, and turns them into mucus-coated marbles. The mucus not only hinders the secretion of the gastric juice, but also prevents what gastric juice there may be from getting at the food. In other words, digestion proper in the stomach is absolutely suspended for the time being. The chill or catarrh thus started, may affect the entire alimentary canal and the mucous membrane of all the organs connected with it. It may, on the other hand, merely result in a violent attack of vomiting, which affords a disagreeable but comparatively satisfactory conclusion to the immediate difficulty.

Food when too hot.—Food that is taken too hot or too highly seasoned, may do quite as much harm as food that is taken too cold. It acts as an irritant. This means that the food is passed out from the stomach into the intestines before the stomach has properly prepared it. Such food may also irritate the stomach itself in such a way that the pyloric orifice, becoming spasmodically closed, prevents the passage of the food into the intestine, and thus gives ample opportunity for fermentation, putrefaction and other evils.

Improper feeding; its general results in the stomach.—By any of these ways of improper feeding there may be produced in the stomach, from the resulting fermentation :—

(*a*) Flatulence.
(*b*) Over-acidity of its contents.
(*c*) Over-secretion of mucus.
(*d*) Insufficiency or absence of its movements.
(*e*) Its distention by fluid and consequent dragging on and irritation of its nerves.
(*f*) Its distention by gas, with consequent pressure upon the heart and lungs.
(*g*) The irritation of those of its nerves derived from the solar plexus, with consequent stimulation of the inhibitory ganglia of the heart, or with production of spasm of the bronchioles.

Various difficulties which may arise.—The particular and evident effect varies enormously. The sufferer, according to circumstances, may experience water-brash, heart-burn, dragging pains, pains referred in various directions, nausea, vomiting, oppression, distention, palpitation, hiccoughs, eructations, difficulty in breathing and innumerable other phenomena secondarily derived from the imperfect action of the stomach and of the other organs, all of which phenomena are usually included under the head of dyspepsia.

But the stomach may be thoroughly out of order without any warning symptoms referable by the patient to the stomach itself. Its contents pass into the duodenum, and, unless these have been properly prepared (unless the chyme has been properly mixed), the duodenum may have to suffer for it.

Foods in the duodenum.—For the duodenum is

a species of second stomach. We have seen that it is at this point that both the bile and the pancreatic juice are poured into the alimentary canal; and that it is at this point also that the fats, after the removal of their coverings in the stomach, should begin to be digested.

Fats; their fermentation: undigested fats.—But if, for any reason, the fats and starches have undergone butyric acid or acetic or lactic acid or alcoholic fermentation in the stomach, the resulting over-acidity of the chyme will neutralize the alkalinity of the bile and of the pancreatic juice. This will delay or even prevent pancreatic and intestinal (enteric) digestion.

Starches converted into acids.—If starches have been partially converted into acids in the stomach, in consequence of fermentation, the resulting acidity of the chyme, as it enters the duodenum, will tend to prevent the further digestion of the starches by the pancreatic juice.

Fermentation in the colon.—Such starches may then be excreted undigested; or they may undergo further fermentation in the intestine; or they may pass into the colon and ferment there. Such fermentation in the colon may become apparent by reason of the frothiness of the excreta.

Over-acidity of the chyme: its causes and effects.—No matter how caused, whether by a superabundance of the hydrochloric acid naturally present in the gastric juice,* whether by lactic acid fermentation, or

* NOTE.—It has been found that hydrochloric acid hinders the excessive formation of the organic acids and the process of fermentation. If, how-

by butyric or acetic acid fermentation, over-acidity of the chyme will delay or prevent pancreatic and intestinal digestion. And from delayed intestinal digestion arise irritation of the intestine, chronic torpor of the liver, and constipation due to the action of the acid in thickening the bile and thus hindering its flow; also non-emulsification of the fats, emaciation and occasionally diarrhœa.

Such considerations as these should show how important it is in these hidden and occult processes of the body, not only that the right "juice" should act on the right food, but that it should act on the right food at the right time, in the right place and in the right way. For the "juices," as for the man, this is the secret of right living.

Dilatation of the duodenum; its results; its symptoms.—Dilatation of the duodenum is caused by gas formed as the result of fermentation, in the stomach and in the duodenum itself. This dilatation disturbs the proper relation of the duodenum with the surrounding organs, and may even result in closing the "valve" which leads from the duodenum into the top of the small intestine.

Relief may be obtained by a return of the gas into the stomach, which sometimes happens, as well as by its passage into the intestine.

The evident symptoms of dilatation of the duodenum are weight and oppression, with the ordinary

ever, the hydrochloric acid is in excess, there is great trouble in the stomach. Its presence in right proportion is of great importance. For instance, in ulcer of the stomach there is usually a very considerable excess of this acid; while in cancer of the stomach there is very often a marked if not a total deficiency of this acid.

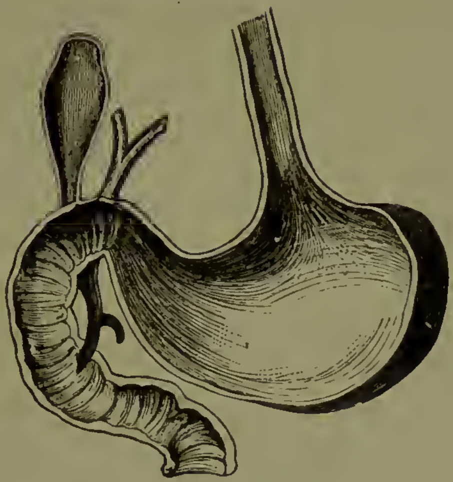

FIG. 21.

symptoms of dyspepsia. There will often be a sense of dragging, which commences a certain length of time after meals, and which is connected with a spot on the right of the spinal column: in fact, many of the symptoms associated with a floating kidney on the right side will often be observable, and care is needed to distinguish between the two possible causes of these symptoms.

Catarrh of the duodenum.—Catarrh of the duodenum may result from a chill, or from food of too irritating a character. Associated with the catarrh, there will often be found a swelling of the papilla—a little eminence at the opening of the common duct which leads from the pancreas and the liver.

Pancreatic digestion.—It is difficult to trace the action of specific foods upon the pancreas, but its action upon the foods is well known, and should this important organ become diseased, as by congestion,

irritation or cancer, the pancreatic juice can no longer be secreted, or, at the best, it can only be secreted very imperfectly. In this case, the digestion of the proteids left over from the stomach, the continued digestion of the starches, and the emulsification of the fats, will be impeded, to a greater or less degree and in proportion to the extent to which the pancreatic flow has been affected.

Examination of the fæces as a test.—This condition is easily seen by the examination of the fæces. Progressive emaciation and ultimate exhaustion may result.

The liver as a filter.—At this point it will be well to touch upon the important part played by the liver in eliminating poisons and preventing their entrance into the circulation.

It will be remembered that the liver lies between the portal vein and the general circulation; that it stands, in a sense, as the gate-keeper of the circulation—as both gate and gate-keeper.

Peptones; as food and as poisons.—Now we know that digestion of the proteids in the stomach and intestines results properly in the formation of "peptones," which are absorbed into the capillaries and pass through the portal vein into the liver. How vital is the health and activity of the liver may be gathered from the fact that if these peptones (though the end and aim of the proper digestion of proteids), should be injected into the blood without having been previously acted upon by the liver, they would kill the body as surely as does the poison of a snake. For snake poison itself is a peptone, and may be

taken into the stomach without evil effect, though if injected directly into the blood, it will prove fatal unless promptly treated.

Ptomaines.—In exactly the same way, some of the poisonous products formed in the alimentary canal through the action of microbes would prove fatal to the body if it were not for the eliminating power of the liver. These poisonous products are known as ptomaines. They are constantly present in prolonged putrefactive fermentations. Their action is similar to that of the poisonous bases of hemlock, mushroom and tobacco. (Smokers may recall their sensations after their first pipe or cigar.) The direct action of the ptomaines is highly irritant and fatal, examples of which may be seen in the sudden illnesses following the eating of imperfectly preserved meats. (See also p. 117.)

Leucomaines.—Besides the ptomaines (the alkaloids of putrefaction), there are the leucomaines. These are alkaloids derived from albuminoid substances in the alimentary canal, and, unlike the ptomaines, the leucomaines are not dependent upon the presence of microbes for their formation. They are excretory products. The leucomaines exert a powerful effect upon the nervous centres, producing sleepiness and heaviness, sometimes vomiting and violent diarrhœa. Their action also is similar to that of snake poison. Examples of their effect may be seen in cases of poisoning with shell-fish such as the common mussel.

Lastly, there are the albumoses, the imperfect products of digestion, which, in excess, have a very deleterious effect upon the organism.

Liver eliminates poisons.—While the kidneys help materially in the elimination of poisons, the greater and most important part of such work is done by the liver. It will therefore be seen that if the liver be sluggish or not up to its work ; or if it be overworked ; or if for any reason it be unequal to its task, self-poisoning or auto-intoxication may be set up, the results of which will vary according to the organ attacked, though the poisons themselves, before they can take effect, must in all cases be conveyed and circulated by the blood.

Foods in the Intestine.—We have now in some degree traced the effect of improper feeding upon the stomach and the duodenum, and have observed the reaction of these organs and the pancreas, when in an unhealthy condition, upon the foods. We have also noted some of the general symptoms resulting from disturbance in those organs. Incidentally we have referred to the continuance of these disturbances in the intestines.

Paralysis by carbonic acid gas.—The fermentation begun in the stomach and continued in the duodenum, is carried on still further in the intestine, where it also gives rise to dilatation, which is not the most serious result, however. Paralysis may be produced there as the result of distention and the absorption of poisonous materials, such as carbonic acid gas, which first stimulates intestinal action but later on paralyses it.

Over-stimulation and paralysis of the intestines.—Torpor, almost amounting to paralysis of the intestine, may be the penalty paid for the improper use of purgatives.

Fruits, &c., increase the trouble.—Many fruits, mineral waters, whole-meal breads, as well as drugs, while at first relieving constipation, ultimately increase the trouble; and why? *Because they do not attack the cause.*

They merely irritate and over-stimulate the intestine; in the end this means exhaustion and paralysis. These stimulants gradually lose their power, as is well known, so that larger and still larger quantities have to be taken to produce any effect at all. Under this treatment, the intestine, like some habitual drunkard, loses its muscular power, even if it retains sufficient sensibility to undergo spasmodic but unhealthy stimulation through the use of agents of constantly increasing power.

Catarrh of the intestinal tube.—Catarrh of the intestinal tube is a common trouble. Just as the inhalation of irritant substances will provoke weeping of the mucous membrane of the nose (catarrh), so small quantities of irritant substances, continually passing along it, will produce catarrh of the mucous membrane of the intestine and of the other organs of the alimentary canal. Over-acidity of the intestinal contents, resulting from fermentation or from other causes, will act as an irritant in this way, and will cause an over-secretion of mucus in the intestine. The mucus, so secreted, will thicken, owing to the action of the acid. In this thickened condition it will be deposited upon the walls of the intestine like a coat of varnish, clogging the villi (see p. 134 and 82) and greatly hindering the absorption of even such food as has been properly prepared for absorption.

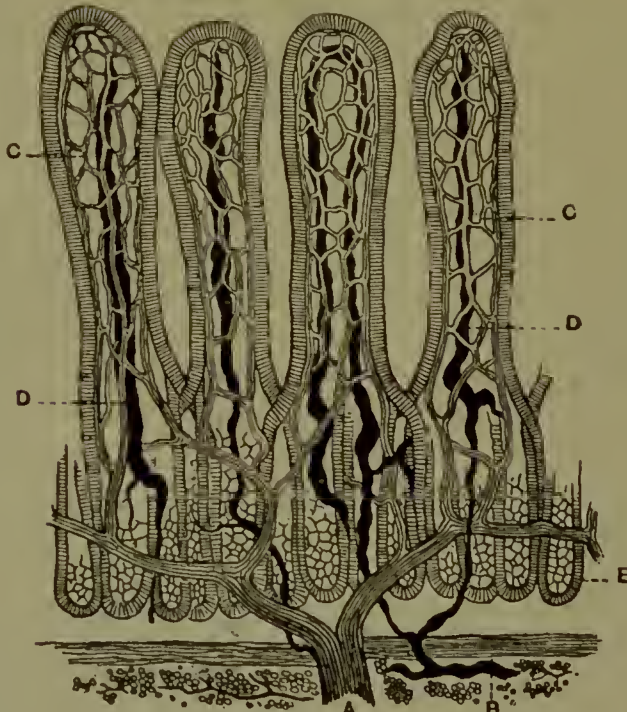

FIG. 22.
A Blood-vessel. B Lacteal trunk. C Capillaries of villus.
D Lacteal capillary.

Over-retention and re-absorption of waste.—Over-retention of matters which should be excreted, as, for instance, the greater part of the bile, in either the large or the small intestine, may involve the re-absorption of such matters into the capillaries; possibly into the general circulation. If these matters be absorbed by the lacteals, they will pass by the thoracic duct into the circulation. If they be absorbed by the capillaries of the portal system, they will be carried to the liver, and, at best, will then oblige the liver to do its work twice over.

Paralysis of intestinal cells.—Should the cells of the intestine be paralysed, effete matters will readily pass through the walls which should enclose them and so make their way into the general circulation by way of either the capillaries or the lacteals.

Eruptions of the face (various causes).—One of the least of these evils, though sometimes the most disagreeable, is disfigurement of the face by acne, erythema or eczema. The poison, once in the blood, finds an outlet along the line of least resistance, which frequently means the face, owing to the fact that the skin of the face is more exposed and is also very abundantly supplied with blood-vessels, and is therefore more open to irritation than any other part of the body. The least surface irritation draws the poison to that point, which then becomes a centre of discharge.

Eruptions on the face may also be caused by lack of proper nourishment, giving rise to poverty of the blood, which leads to an impaired vitality of the tissues. The same result may follow constipation, and also unskilled efforts to relieve the constipation, as by the long continued use of saline aperients.

Foods in the large bowel.—In our consideration of the effects of improper feeding upon the organs of the alimentary canal, we have not as yet reached the colon, sometimes known as the large intestine or bowel. The large bowel is the organ *par excellence* of healthy absorption. Its peculiar shape, with pouches here and there in which the food rests on its way towards the rectum, makes it a kind of filter-bed. Its sharp turns or flexures seem designed to promote delay in the passage of matter along its course. But

for this very reason, though healthy absorption is assisted, unhealthy absorption is made possible.

The ileo-cæcal valve.—The ileo-cæcal valve, which leads from the small intestine into the large, prevents the passage of matter backwards from the large intestine into the small. The presence of this valve gives opportunity for blockage and for unhealthy delay in the movements of the contents of the bowel, which not only becomes abnormally distended, but also more or less packed with hardened contents. This hardened material clings to the walls of the bowel, which, like an encrusted drain-pipe, may present a two-inch diameter, seen from without, with an actual aperture of only three-quarters of an inch in diameter running through it.

Sagging of the transverse colon.—The whole course of the bowel is liable to distention, from the fermentation of improper foods or from other causes. In such circumstances what is known as the transverse colon (that part of the large intestine which crosses the body horizontally, above the small intestines, for which see p. 68), may "sag" in the middle and drag down. This involves the formation, at each top corner, of points of great irritation. The same result may follow from want of tone.

Turns of the sigmoid flexure.—Such sharp turns as these, with the turns of the *sigmoid flexure*, in which material can easily lodge, are among the points most frequently affected by cancer of the bowel.

The chief dangers.—Over-retention and distention are the two chief dangers to be guarded against. Appendicitis may result from distention, as by gas,

permitting hard or irritating material to pass into the *appendix*.

Appendicitis.—The *appendix vermiformis*, or blind gut, is an elongated process which starts from the bowel near the ileo-cæcal valve and which seems to lead nowhere. If the bowel become distended, as by gas, the opening of this appendix is stretched and materials may pass into it, may linger there and may set up ulceration, and ultimately, the very serious trouble known as appendicitis, or inflammation of the appendix.

Ulceration.—Ulceration, although now mentioned for the first time in this chapter, is a trouble to which the whole length of the alimentary canal is liable. An ulcer is an open sore, formed at some point at which there has been irritation or congestion, or which has been subject to mechanical injury or microbic invasion in the course of some disease such as enteric fever (typhoid), or tuberculosis. Ulcers are greatly aggravated by the passage over them of improper or undigested foods. Their effect on food is towards the formation of ptomaines.

Before leaving the subject of the large intestine, it should be stated that too hard a drinking-water, that is to say, water with too much lime in it, is liable to constipate the bowels, or to produce irritation with its accompanying disorders. A change in the character of the drinking-water, replacing hard water with soft, will frequently produce beneficial results.

The rectum.—The next and last organ of the alimentary canal, which calls for notice in connection with improper feeding, is the rectum.

Piles.—The rectum is subject to what are known as

piles, these are simply veins, partly or very much distended. They become distended for the following reason: that, unlike the other veins, which are supplied with valves to carry the weight of the blood immediately above them, and so to save over-pressure on the bottom of the lower veins, these veins of the portal system have no valves. It follows, therefore, that the lowest part of the portal circulation has to support the weight of the whole column of the blood within that circulation. It is as if a long tube with a closed bottom were filled with water. The bottom may be strong enough to support the weight in ordinary circumstances, but suppose that pressure at the top were added to the natural weight of the water within the tube. It is then easy to see that this added pressure might prove too much for the strength of the bottom, which would probably crack and leak. Now the liver may produce the same effect as a heavy weight added to the natural weight of the contents of the portal circulation. If there be obstruction, or pressure or congestion in the liver, whether of bile or blood, the circulation of the blood in that organ will be impeded. This will mean pressure at the top of the portal circulation—the liver being its topmost point—taking immediate effect at the lowest point of that circulation, namely in the rectum. Distention of the veins of the rectum, commonly known as piles, is the almost inevitable result.

Hardening of the fæces.—If, in addition to this, the fæces should be hard, there will be extra pressure, pushing everything before it, and producing much the same effect as the piston-head of a pump produces

when pressing against the walls and contents of the cylinder.

This hardening of the fæces may be due to insufficient secretion by the mucous membrane of the bowel; or it may be due to over retention of the contents of the bowel with consequent absorption of liquid; or it may be due to insufficient drinking.

Fissure.—Fissure, or cracking of the wall of the rectum, may result from over-distention by hardened material.

Fistulas.—A fistula arises from an abscess in or near the wall of the rectum. The abscess bursts into the wall of the bowel, and the hole thus made does not afterwards close if fæcal matter once passes into it. A fistula may also arise as the result of ulceration penetrating the wall of the bowel. The cause of the ulceration may be mechanical injury, as by a fish-bone, or it may be due to tubercle.

A healing tendency.—Most careful dieting is necessary in these circumstances. A healing tendency must be given to the tissues, and irritating substances must, so far as possible, be kept from the rectum.

CHAPTER XII.

FURTHER EFFECTS OF THE FRAY; THE DESTRUCTION OF THE BALANCE.

The kidneys.—Although the kidneys, properly speaking, are outside the alimentary canal, they may be considered as mechanism supplementary to this great factory of the body. They form part of the mechanism whose function it is to throw out waste materials. If they throw out the wrong materials, or if their work of excretion be impeded or temporarily stopped, dire results may follow.

Diabetes.—The kidneys may throw out the wrong materials, as in diabetes—which is a "running through" or discharge of sugar (glucose) in the urine, with great increase in the quantity passed. This greatly exhausts the body and may ultimately wear it out. Various skin troubles may also arise from the same cause.

Saccharine diet.—A diet too rich in saccharine matters, or in matters, such as starch, which are easily converted into sugar, will aggravate diabetic trouble if that be present.

Proper dissolution of excretory matters.—The

proper dissolution of matters intended to be excreted by the kidneys is of great importance. Materials which should be excreted in this way, if imperfectly dissolved—or if dissolved in too large quantity—may give rise to what is known as gravel.

Gravel.—Granted the presence of some irritant focus, the same condition may lead to the formation of various forms of "stone," anywhere along the length of the urinary passages, but particularly in the bladder and in the immediate neighbourhood of the kidneys.

This imperfect dissolution may be the fault of the liver, or of one or more of the organs of the alimentary canal.

Phosphatic and nitrogenous wastes.—As the nitrogenous and phosphatic wastes are those which are chiefly excreted by the kidneys, it becomes of importance to see that these wastes are so formed that they pass readily in solution through the kidneys, out of the body.

Quality and proportion of food.—This result may be obtained by the proper preparation of the various food-stuffs, and by strict supervision of their quantity in relation to each other; also by securing the proper activity of the organs of digestion, so that the blood which contains the food, together with the nitrogenous wastes from the liver, the muscles and other organs of the body, may contain these in a state of complete solution and in no immoderate quantity, before this blood reaches the kidneys.

The chief point to remember in this connection is this :—

It is not so much the quantity of nitrogenous matter consumed which is liable to create trouble, as the quality of that food and the proportion in which it is digested or thrown to waste.

The proportion thrown to waste depends upon the method of its preparation and upon its admixture with other foods, the digestion or fermentation of which interferes with the proper digestion and elaboration of the nitrogenous foods.

Insufficient liquid and gravel formation.—The work of the kidneys may be impeded by taking too small a quantity of liquid, for this involves the passage of the wastes in too concentrated a form. The formation of gravel is assisted in this way.

The lungs and bronchial apparatus.—The lungs and the pulmonary apparatus as a whole may, like the kidneys, be considered as mechanism supplementary to the work of the alimentary factory.

Carbonic acid as result of combustion.—It is in the mucous membrane of the lungs that the results of carboniferous combustion of foods are to a large extent got rid of. We have already studied the action of the lungs in disposing of the carbonic acid given off as the result of combustion (see p. 24), and we know that it is not only in the lungs that carbonic acid is to be found, but that it is carried by the blood to the lungs from all parts of the body where combustion takes place.

Various results of superfluity of carboniferous food.—Now if more food of the carboniferous kind (starches, sugars, fats, etc.), is eaten than is properly

consumed, what must invariably happen? One result is that some time after each meal the blood becomes over-loaded with the products of these food-stuffs; another result is that the lungs become congested and inflamed by overwork.

"Catching Cold" a chronic tendency.—If this congestion and inflammation affects only the upper part of the pulmonary apparatus—the upper part of the windpipe or of the bronchial tubes—a slight but chronic "cold" shows itself as a symptom of the underlying trouble. The immediate cause of the cold may be a draught acting upon the inflamed or congested surface of the mucous membrane; but without the inflammation or congestion the draught could have done no damage.

Broncho-pneumonia.—This explains the chronic tendency, from which so many people suffer, "to catch cold." Should the fundamental cause of the trouble—the over-eating of carboniferous foods—continue, the inflammatory condition may spread to the sub-mucous tissue and to the air-cells of the lungs.*

Broncho-pneumonia will be the symptom, whenever external conditions favour its development. "Influenza" may be a preliminary symptom, with the usual pains in all the limbs and with fever. Microbes, if microbes be the immediate cause, can do little if any harm unless the diseased tendency already exists.

Microbes in mucous membrane.—Microbes must have a soil suitable for their development, and the soil most suitable to this which they can find is an inflamed or congested condition of the mucous membrane.

* NOTE.—See *Air, Food and Exercise*, by Dr. Rabagliati.

Tuberculosis: scientific feeding.—Even in the case of tuberculosis (consumption), the body may be made fit or unfit for its development: the growth of the tubercle bacillus may be aided or retarded—even prevented—and chiefly by means of scientific dieting. The ignorance that prevails in regard to this basic law is simply appalling. I have no hesitation in saying that many thousands of valuable lives have been needlessly sacrificed year by year for lack of a proper understanding of the effects of the different foods upon the organism.

Inherited tendency overcome.—If dealt with in time, there is no doubt that an inherited tendency for consumption may be permanently overcome.

Starving the microbe.—The body may be made so healthy that it will be able to repel the invading microbe, and should the invader have gained a foothold already, before treatment has commenced, it is yet possible to starve him out, while building up the body, so long as the disease has not gone too far for cure.

Effect of superfluity of carboniferous foods on muscles and joints.—It was said that if more food of the carboniferous kind be eaten than is properly consumed, one result is that some time after each meal the blood becomes overloaded with the products of these food stuffs.* The blood in its circulation

* NOTE.—The same may be said of the proteids as well. But as a rule the carboniferous foods are largely in excess of the nitrogenous in any person's dietary. Moreover, the carboniferous foods are most easily acted on by the ferments, and thus not only produce wrong products of digestion themselves, and fail to give nourishment, but also in so doing they upset the digestion of the nitrogenous foods.

through the body tends to deposit these products upon the muscle sheaths, upon the sheaths of tendons and joints, and elsewhere, instead of doing its proper work of nutrition and removal of waste material. The blood is already loaded with more than it can properly carry, and so it unloads itself on the tissues instead of carrying away all that it ought. It is trying to adjust its own balance. A regular sediment is thus formed, the consequence of which is muscular rheumatism or stiff joints, or both, as the case may be.

On the nerves.—And this is true, not only of the muscle and joint sheaths, but of the nerves also. The impure contents of the blood are deposited upon the sheaths of the nerves, and neuralgia or paralysis may result—strange as such an alternative may seem at first sight. But only at first sight, for paralysis, or the absence of nerve activity, may be due to starvation, and is merely the opposite pole, as it were, of neuralgia, or over-activity of the nerves ; and deposits from the blood upon the nerve sheaths may be of so poisonous a nature that paralysis of the nerves may result. Indeed, the neuralgia (or the paralysis), may result from starvation if the nutrition should fail from inability of the blood to carry food ; this inability would be owing to the excess of improper material which it carries in consequence of digestive failure. The proper work of the blood fails because it has too much other work put upon it to do. Of course paralysis may also be due to injury of a more direct nature, such as the bursting of a blood-vessel ; or to chronic inflammation of the nervous tissue ; or to the

exudation of material around the nervous tissue, leading to the formation and contraction of the connective tissue, with the ultimate destruction of the nervous tissue contained in it.

Connective tissue.—Improper feeding, by the way in which it affects the blood, has a very decided influence upon the development of all kinds of tumour, whether benign or malignant. Anything which tends to cause the blood to congest or to be overloaded with fibrin is likely to promote the growth of a tumour. On the other hand, proper feeding and the stimulation of the absorbent mechanism of the body will often lead to the dispersal of a benign tumour; while much can occasionally be done even in the case of a malignant tumour, such as cancer.

Scirrhus.—In this case, however, the element of time is of the utmost importance, because so much depends upon the stage the cancerous growth has reached. Much depends also upon whether secondary deposits are being made in the body; and upon the situation of the growth.

Vascular tumours.—For the more vascular the tumour (the more numerous the blood-vessels in and around the tumour), the less chance is there of effecting benefit by slowly acting physiological and pathological means.

Over-eating and tumours.—The main point which I would emphasize in this connection is that continued over-eating or continued indigestion offers the most favourable soil it would be possible to devise for the development of tumours of every kind. This fact holds good whether these tumours arise by a process

of "tissue riot" through irritation by micro-organisms or not. And as very few, if any, people are willing to admit that they over-eat, it should be remembered that such are not trained to judge, by pathological or physiological observation, whether they do in truth over-eat or not: their sensations are not in question, but only the bodily condition as observed by the expert who is trained to observe, and, above all, trained to separate cause from effect; that condition as he finds it to be is the sole means of judging whether more food is taken than the body can properly dispose of—or the wrong kinds of food. The popular meaning of the term "indigestion" is a purely arbitrary one: in its real meaning the term covers all the abnormal results of impaired action of the digestive organs. How far more numerous these abnormal results are than is generally supposed, it is the main object of these pages to reveal.

Skin troubles and impaired circulation.—We have seen already how skin eruptions may be caused (see p. 135); but there is one form of skin trouble which may be due to impaired circulation, as by tight-lacing, or to indigestion and over-acidity of the stomach arising from the fermentation in the stomach of the starches and sugars contained in the diet. This particular trouble is commonly known as "red nose." The form of fermentation which frequently produces a red nose is alcoholic fermentation, and it is curious to note, in this connection, the large amount of bread and sugar consumed by some total abstainers, who, on this account, show superficial signs of intemperance. In such cases, the unconscious offender is con-

victed of "running an illicit still" in his own stomach! The form of fermentation, the stimulation, the "drop" and nervous reaction, and the terrible craving for these foods if they be dispensed with, are the same in kind as the symptoms arising from undue use of alcohol, and the subsequent reaction.

"Bad circulation."—If the digestive organs be irritated, they draw to themselves an extra supply of blood away from the rest of the body. This withdrawal of blood from the rest of the body accounts for the icy-cold feeling which often accompanies severe indigestion.

Overloading the blood: congestion.—Congestion is likely to result whenever the blood is overloaded with improper materials. For this overloading thickens the blood, and the flow of the blood through the small capillaries is thereby impeded. This leaves the tissues without nourishment, and also encumbers them with an accumulation of their waste products which, in ordinary circumstances, the free circulation of the blood removes.

Congestion is, in fact, an upsetting of the balance between waste and repair. We know the meaning of congested traffic in our streets: new supplies fail to reach us and waste matters, which should be removed, remain on our hands. It is the same with the blood.

And this leads to a point which might have been introduced under the sub-title of "The Lungs," or under almost any of the preceding sub-titles. It is a point of universal application, physiologically speaking.

Circulation of unhealthy blood.—Suppose that the body is in a state of delicate equilibrium as between

waste and repair, and that all the excretory organs are barely equal to the demands made upon them. The blood is then full of matters which the combined efforts of the glands, both excretory and secretory, can only just manage to deal with. Suppose, again, that in these circumstances some part of the body should be exposed to irritation, as by a sudden change of temperature, or by the breathing of irritating material, or by the eating of irritating food. In this event, just as a grain of mustard on a frog's foot will produce a determination or rush of blood to the spot irritated, so, in the human body, irritation of any part produces a determination of blood to that part, the effect being more or less profound, according to the area irritated. But unhealthy blood does not withdraw as easily as it rushed in ; and the result is a congestion of that area, with an increased effort by the part attacked to secrete freely in order to relieve the congestion. If this extra secretion should not give relief, the continued congestion gives rise to inflammation—nature endeavouring to relieve the situation by the destruction of the congested materials.

Distribution of the blood.—In these circumstances the distribution of the blood to all the other parts of the body obviously becomes of the first importance. Add to this distribution the removal from the blood of that which makes it "inflammable":—

(*a*) By starving it ; or,

(*b*) By increasing the activity of the other organs.

If these methods succeed, a cure will result.

Vital resistance of the blood.—One fact must be well borne in mind :—

Quite apart from a possible cure, the processes of congestion and inflammation just described lie at the root of all disease, whether acute or chronic.

If the blood be in a healthy condition ; if, so to speak, its vital resistance be good ; if the balance between waste and repair, nutrition and excretion, be maintained, determining causes (microbes, irritants, injuries, heat or cold or what not), will have little effect upon the organism.

General consequences of improper feeding.—Summing up the effects of improper feeding upon the organs, and the reaction of those organs, once upset, upon even proper foods, it should readily be seen that the chief danger in the present methods of European and American feeding is the consumption of an undue proportion of starch and sugar in view of the occupation in life of the average individual. While these classes of foods have their undoubted utility for those who can digest them, *and whose occupation assists the process of digestion*, a very large proportion of people, from one cause or another, can deal with such foods in a strictly limited proportion and quantity only.

People of more or less sedentary habit are particularly prone to be upset by these foods, and it is just such people who are apt to confine their diet very largely to starchy and sugary compounds, finding them "bland," "unirritating," "unexciting," *and* cheap, and, in addition, quickly and easily prepared.

As we have seen, it is these foods which are most

prone to undergo fermentative decomposition, with all its attendant evils, in place of proper digestion. The result of this, at the best, is lassitude, or irritability, despondency or lack of self-control. But these and the numerous physical effects we have been considering, though slight in their beginnings, are liable to become continuous, and by slow degrees to become aggravated. Organs, like individuals, are quick to acquire habits; and habits, once set up, are difficult to overcome. The sufferer is thus confined within the limits of a vicious circle, until some one relieves him by striking deep at the cause of his trouble, which, in the vast majority of cases, will be found to be improper feeding, probably aggravated by lack of proper air and exercise. A condition of mal-nutrition has been established, of "starving in the midst of plenty"—for it is probable that any quantity of the wrong sort of food has been eaten. In our extraordinary view of life, we even think to "entertain people by feeding them, usually with the very foods which are almost acting as a slow poison to them, rendering them unfit for the battle, even for the ease and pleasure of life. When one comes to think of it, it is a savage and most uncivilized view to take—that in order to be really "hospitable" to our fellow man, we must be hospitable to his stomach, and hospitable to all manner of disease therein. The perpetual overloading of the digestive organs, so common to our modern life, the equally perpetual formation of imperfect and wrongly elaborated products of digestion, the continual disturbance of the balance of nutrition and of the relation between

waste, repair and removal of refuse—all these inevitably tend to increased wear and tear of the body and to its premature senility and decay of the tissues. The body wears out before its time, and old age and death arrive before their normal period. But it need not continue. Nature may yet be helped to repair the damage done.

An example from real life.—Before concluding this chapter, it may be well to give an example—and a warning—from real life, in order to illustrate the conclusions put forward. The following extract is taken from the letter of a surgeon with a large practice, who wrote to me describing his symptoms and asking for advice. These are his words : " After meals a sense of fulness and discomfort ; no actual pain. Flushing of face and ears, especially after dinner at night. Seldom any actual pain. When pain does arise it is of the nature of colic, and is severe while it lasts. Any extra worry or anxiety shuts my digestion up like a knife—if I may use the expression. I can actually feel my digestion stop. My liver is always more or less torpid, with the usual feeling of lassitude. Spots nearly always floating before my eyes, and a tendency to look at things out of dark spectacles. Am irritable and often morose ; find it difficult to control my temper ; become sarcastic and ready to find fault. My nerves appear to be always in a state of tension, and if I were a woman" (the writer was a bachelor), " I should become hysterical at times. Have always a feeling of unrest, finding it exceedingly difficult to rest or to read anything but text books or articles on my work. Always a desire to be active and to be doing something. I often get

muscular pains and pains in my joints, hands, wrists and feet. When much exhausted, have constant drumming in right ear and vision gets clouded. Sometimes dull pains in lumbar region. At times neuralgic pains in head when run down. At night sometimes a curious irritation of skin and scalp, which usually precedes an attack of liver."

And now for the diet of the sufferer, the key to the situation in his case. "At 8.30 a.m. breakfast. A bowl of porridge with stewed fruit and milk. Two slices of bacon, as fat as possible, with an egg poached or boiled. One large cup of tea with cream and sugar, and a piece of toasted Hovis bread, with butter and marmalade. My breakfast is one of my best and most enjoyable meals."

For dinner, he had some soup, meat, potatoes, and another vegetable, some farinaceous pudding; then cheese with biscuit and butter. A glass or two of wine. Supper of milk and bread, sometimes cheese and fruit.

And little or no exercise! It would be difficult to devise a diet more likely, in such circumstances, to provoke fermentation, improper and insufficient removal of waste materials, with all the symptoms described in the body of the letter. And yet how many thousands of people could claim similar symptoms, and could, if they would, plead guilty to just such a diet—with the addition of afternoon tea, consisting of bread and butter and cake, or perhaps jam and hot scones! It is fortunate that the human organism has a wonderful power of resistance and an immense tenacity in its effort to maintain a healthy equilibrium, in spite of man's unconscious efforts to upset it.

CHAPTER XIII.

IMPROPER ACTIVITIES OF THE BODY.

Other ways of disturbing health.—We have now to consider how the equilibrium called health may be disturbed in other ways as well as by improper feeding. These other ways, however, will not require such detailed attention as the way we have just been considering, for, fortunately from one point of view, unfortunately from another, the evil effects of improper air, insufficient movement and cleansing, and of wrong thinking, have become matters of more or less common knowledge within the past few years.

Improper breathing.—So much has been said already in these pages concerning the absolute need of the organism for proper air, that the effects of improper breathing should be readily understandable. We can live for several days, even for weeks, without solid food; but we cannot live for five minutes without fresh air. Unless the blood carries oxygen from the lungs to all parts of the body, combustion cannot take place; and unless the blood is able to get rid, by way of the lungs, of the carbonic acid gas which it has conveyed from all parts of the body where

combustion has taken place, the bodily mechanism becomes blocked and paralysed by the accumulation of its own wastes. Proper breathing plays a part little short of extraordinary in its importance in preserving the equilibrium between waste and repair; improper breathing is responsible for a vast amount of ill-health. And just as the digestive apparatus may be upset by improper food, and while the digestive apparatus, once upset, may convert even proper food into poisons, so improper breathing may wreck the breathing apparatus; this apparatus, once diseased, may deprive even the purest air of its value.

We have seen what evil effects may be produced on the pulmonary apparatus by improper feeding; how the mucous membrane may be given an inflammatory tendency, and how the muscles and the lung-tissue which enable the act of breathing to take place, may lose their elasticity and strength—effects which render proper breathing almost impossible. "Skimpy" or surface breathing may ultimately produce the same effect. The lungs become flabby; parts of them—either the tops or the bottoms, according to the personal habit of breathing—even gradually atrophy; then the blood, insufficiently oxygenated, becomes poorer and poorer, while the waste matters of the body block the circulation, stiffen the joints, press like lead upon the nerves, and paralyse the muscles. Of course these results are gradually brought about. Long before such marked symptoms are observable, the lungs themselves have become weak and incompetent, inclined, rather than otherwise, to all the ills that lungs are "heir to."

Disadvantages of civilised life.—The fact cannot be too frequently emphasised that if we are to neutralise many of the disadvantageous circumstances which modern civilisation involves, *much care on our part is necessary.* We must breathe, as well as eat, carefully and fully and regularly, if we would not succumb to the physiological inertia which civilisation with its express trains, its motor carriages and lifts, has made perfectly compatible with an intense physical activity.

A comparison may render the matter more clear. If we want a fire to burn brightly we require a free passage of air through the coals. We shake out the ashes and clear the grate bars until there is no ash or clinker, and air is freely admitted to the burning surface. If we want a slow, slight fire we damp it down with ashes. But in this case we run the risk of our fire going out through insufficient combustion of the coal. The wise housekeeper will also see that the chimney is kept properly swept. Thus insufficient air means a "damped" vital combustion, with insufficient removal of waste and lessened vital heat. The "ashes" occur not only in the lungs (in the form of wastes that are not removed), but also in every part of the system to which air ought to be carried by the circulating blood.

But more will be said on the subject of breathing when we come to consider the treatment of unhealthy tendencies and conditions. The effects of improper and insufficient movements now require attention.

Improper and insufficient movements. Muscular atrophy.—Insufficient movement of the muscular system may lead to atrophy of the muscles. This

atrophy will be local rather than general, for most people exercise *some* of their muscles, though even those who make a point of "taking exercise" might be surprised if they knew how few muscles are actually brought into play by such exercise as slow walking on level ground. Several of the muscles in the legs, even, are left entirely unused by walking of that sort.

Unused muscles.—For example: let a man who constantly walks on level ground attempt to climb the side of a steep hill. He will find the great lifting muscles in the front of the thigh becoming very tired and even painful. Perhaps a more familiar example is the muscle fatigue experienced by the unaccustomed bicyclist. Or again, consider the fatigue brought on by dancing when people have not indulged in this pleasure for many months. These are only some among the examples to be drawn from the muscles of the leg. Then there are those of the trunk of the body, both back and front of the arms. Let ladies who are accustomed to the use of stays, whether tightly laced or not, recall the backache they endure if for any cause they have to temporarily leave them aside, and are then compelled to move about or (still worse), stand about. The ache and fatigue in the muscles of the back, thus suddenly called upon to hold the body erect, are well remembered, but usually, alas, do not lead to the development of the muscular power, but only to the urgent insistence on the necessity of the mechanical support of the corset. Nature has given a loud hint of her need, but the hint is not taken, and the natural power and needed develop-

ment of health are cast aside for a mechanism which surely injures and atrophies certain important muscles.

Failure of circulation; collapse of nutritional and excretory systems.—Following atrophy of the muscular system, comes failure of the circulation, with collapse of both the nutritional and the excretory systems.

Blood-vessels and lymphatics.—There is nothing to draw the blood and lymph to the parts left unused, and nothing to drive the blood and lymph, with their burden of *débris*, away from these parts. One result of this is the deposit of waste matters in the muscles and joints, with gouty or rheumatic pains as the most evident symptom.

Minute size of blood-vessels.—When it is remembered that the fine blood-vessels which bring the blood to the fibres of the muscles and the sheaths of the muscles and to the membranes of the joints, are of such a size as only to admit one blood corpuscle at a time, and that only if the corpuscle be elastic and squeezable; and further, that this size is but about the $\frac{1}{5000}$th part of an inch in diameter—the lymphatic absorbents being even smaller,—it becomes clear that the preservation of the blood in perfect condition as a carrier of oxygen and nutritive material is of prime importance. That movements calculated to assist in this pumping and drainage process are of equally great importance, is also clear. But exercise must not be overdone, and in impaired health the restoration of motion must be gradual and skilfully directed.

Muscles and joints; gout and rheumatism.—It is worthy of note, in this connection, that the muscles

and joints which are most used (and therefore are the most necessary) are the very parts that are most affected in both gout and rheumatism. This is due to the fact that in those parts the balance between waste and repair is so delicately adjusted—activity being at its highest point—that the least disturbance in the equilibrium produces the most powerful effect. In other words, when the general circulation is weak, and activity is concentrated in one part, that part has to bear the burden of the general weakness. This is like the bridge which is said, architecturally speaking, to be " only as strong as its weakest part."

Violent exercise after inactivity.—The same rule applies to violent exercise after a long period of inactivity. All the waste matters of the body, which have been gradually accumulating and which have been deposited in the tissues, are suddenly stirred up, and are poured into the general circulation. A sharp attack of biliousness is one of the lesser evils which may result from this improper method of taking exercise. Business men, who, though often very heavy eaters, take no exercise during the week, and who try to make up for it on Saturday afternoon or on Sunday, may in this way seriously impair their health.

Acid products of muscular and organic action.—Another result of sudden activity after long continued inactivity, is the increase of the products of muscular and organic action in the lymphatics and in the blood-vessels. These products being mainly of an acid nature, interfere with the normal alkalinity of the blood, which is so necessary to its activity, and greatly favour its congestion. We have seen what the

results of congestion may be. Furthermore, these products are carried by the lymphatics, are mixed with the fats from the intestine, and are poured into the great veins close to the heart and then pumped through the right side of the heart into the lungs. Here there arises an additional danger of congestion for those who take heavy exercise when not accustomed to do so.

Waste matters on nerve- and muscle-sheaths.—Insufficient exercise, resulting as it does in a weakening of the circulation and in the deposit of its waste matters, favours the congestion of the digestive organs and of the liver. It also favours neuralgia and similar disorders, for the waste matters are likely to form a deposit on the nerve-sheaths, as well as on the muscle-sheaths, and thus are likely to paralyse nervous activity on the one hand, or to produce irritation and over-activity on the other.

General result of improper exercise.—To sum up the result, then, of improper and of insufficient exercise, we may say that this result is a sluggishness of the entire organism, with the formation, locally, of points of irritation.

Improper and insufficient cleansing.—Insufficient cleansing of the skin will lead to the accumulation of impurities in the blood. These impurities should be passed out through the skin, but, as explained under the head of "Proper Cleansing," when the pores of the skin are closed, the proper work of the skin is thrown upon the kidneys, and as these are rarely able to do more than their exact proportion of the work of excretion, the impurities remain in the blood, producing skin diseases or lithæmic and similar disorders.

Hours for baths; digestion and the blood flow.—Improper cleansing may produce disastrous results. To take a cold plunge bath after a heavy meal, when the blood has been drawn to the digestive organs, away from the surface of the body, may so increase this centripetal action of the blood that the heart will be unable to re-establish the circulation; that is to say, the shock may result in death. Any bath taken within the hour or two following a meal (unless *immediately* after), is liable to do more harm than good. For a cold bath at first drives the blood from the surface of the body towards its centre, and this induces later a reaction back from the centre to the surface; and a hot bath has exactly the opposite effect. So that although this action and reaction may at other times be beneficial, it is injurious when digestion is taking place, for proper digestion requires an uninterrupted flow of blood to the organs of the alimentary canal.

Improper activity of the mind.—It would be difficult to over-estimate the influence of the mind upon the bodily functions. This influence is exerted both directly and indirectly.

Indirectly, by way of mental habits which induce physical habits.

Directly, by way of the nervous system and the undue wear and tear to which this may be exposed.

We have already referred briefly to this important subject (see pp. 19 and 37), and what was then said might easily be elaborated to fill volumes. But this is not the place for dealing at length with psycho-pathology. I can only express the hope that the matter will

before long receive proper scientific attention. So far, those who have attempted to deal with it, have, for the most part, allowed their zeal to run away with their common-sense. Having adopted the idea that matter has no existence and that the mind is the only reality, they have proceeded to attribute every kind of physical disorder to some wrong condition or attitude of the "thinker known as man." They have approached the subject from one aspect only; they have thus overlooked the tremendous effect that the condition of the body has upon the *functioning* of the mind. Action and reaction are equal (in power). Whatever enfeebles the circulation, impoverishes or overloads the blood, must inevitably impair the working of the brain. Whatever disturbs the nervous equilibrium of the brain must react both upon the blood in the brain and upon all the organs connected with the brain by the sympathetic nerves.

Stomach and brain; their inter-relations.—There is direct connection between the stomach and the brain by way of the pneumo-gastric nerve; there is also direct connection between the stomach and the great centre of the sympathetic nervous system; so that digestion may be absolutely suspended as the result of any sudden shock to the nervous system, whether the shock be to the brain, or to the sympathetic system of nerves. In certain cases, indigestion is entirely due to sympathetic nervous action or inaction.

Nervous energy.—The body is supplied with a given quantity of what might be called nervous energy. All organic activity is dependent upon nervous energy

and tone. If the brain, as the result of worry or of any other intense and continued emotion, uses up more than its due allowance of nervous energy, the digestive organs must suffer, and consequently the general nutrition of the body. The effect reaches further than this, for defective nourishment involves diminution of the original supply of nervous energy. So worry both uses up the store of energy and stops its further supply.

Worry.—Why worry? It is of course easy to philosophize, but if people would remember this one thing, viz.:—

The unnecessary is the immoral; physiologically speaking, at all events:

They would be both healthier and happier than they generally are.

Action of mind on body.—The indirect action of the mind upon the body is also seen to be very marked, once attention is called to it. The effect of mental habit or attitude can nearly always be traced to its ultimate expression in some physical peculiarity. A sluggish mind, one that is lazy and slow to move, owing to the habits caused by this mental condition, will generally be housed in a sluggish lazy body, with a poor circulation and a torpid liver. An inattentive, careless mind is apt to provoke a variety of disorders in the body—disorders which result *directly* from irregularity in excretory activity, from inattention to proper cleanliness of the teeth and the body generally, and, in short, from indifference to all the laws of hygiene. In the same way, petulance and mental

irritability make nervous equipoise impossible, while violent actions and reactions in the mind—mental excitement followed by depression—lead, indirectly, to a physical condition which may roughly be described as alternately expansive and contractive: constipation and diarrhœa will often follow each other for days together.

Mental habits and chronic disease.—This indirect effect of mental habits upon the health of the body constitutes one of the most serious difficulties in dealing with chronic disease, for it is in cases of chronic disorder that these effects are chiefly discernible.

Effect of fear; of anger.—We know, for instance, that intense fear may so affect the action of the heart that death may result. Fear, less intense, but more prolonged, with constant dejection and foreboding, may produce the same result. It depresses the entire system. Let anyone who steps downward unexpectedly in the dark, note the curious contractive effect in the solar plexus. That means a more or less temporary disturbance of the vital functions, unless the balance of health be so good that reaction quickly follows. The effect of anger is as marked. It is a disruptive force and shatters the nervous strength. In a very weak person any strong emotion, such as anger, may so scatter or use up the strength as to exhaust and even paralyse all the vital functions. Fear may drive the blood away from a part; anger may pump it to a part. In either case much harm may be wrought, the amount depending wholly upon the balance of health.

Serenity without sluggishness.—

Serenity without sluggishness: that is the mental attitude which a specialist in chronic disease must wish to see his patients adopt.

The mere fact that they do suffer from chronic disease means, in ninety-nine cases out of a hundred, that this is the very attitude they will find it most difficult to adopt.

But whether the task of the physician be easy or difficult, will in a large part depend upon the mental co-operation of the patient.

Nature's re-adjustments.—No physician is omnipotent. The utmost he can do, as I have said, is to assist by every means in his power the efforts of Nature to readjust herself; to this end Nature labours continually; and while the physician assists Nature, the patient should at the least be careful not to thwart Nature's efforts.

Effect of courage and hope.—The effect of courage and hope in the recovery of health is not to be overestimated. While there is the disruptive effect of anger on one hand, we can also see the contractive effect of fear. Both are injurious to the human organism and involve a misapplication of nervous energy. In the one case it is dissipated uselessly; in the other it is sealed up and its effect is equally lost. This is no place in which to make an exhaustive analysis of the effect of strong emotion upon the body, but in the experience of nearly all sufferers the bad effect is clear.

Two mental attitudes of paramount importance.—In the recovery of health from chronic disease,

there are two attitudes of mind on the part of the patient which are of paramount importance :—

Courage, associated with perseverance and self-denial in carrying out the means necessary to that recovery.

Self-confidence, born of hope that by doing the right thing, the desired end will be attained through the education and evolution of the power—that vis medicatrix naturæ—which heals.

The power resides in the patient.—

No one but the sufferer can do it, though he can be told what to do. In the patient is the power if he will but exercise it.

Hence it is that "systems of treatment" are fostered, proprietary medicines are in vogue because human nature seeks for something which it believes it can understand and can *carry out for itself.* In one sense it is a step in the right direction, though, alas, it often leads to bad results because it is born of little knowledge. Human nature, in the present age, gropes after self-knowledge both mentally and physically, and, as individuals are those chiefly concerned, who can blame them? One very wide definition of insanity is, "the failure of the individual to adjust himself to his surroundings." This is equivalent to his being unable to act and react equally to all the vital constituents, air, food, the social environment—in short, to everything around. And whether the application be mental or physical or physiological, the aim of the individual is to build a temple of health, moral, mental and physical, perfect in its parts (and its united interaction), and honourable to the builder.

CHAPTER XIV.

THE RESTORATION OF THE BALANCE.

The next step.—Before we consider our next step, a brief recapitulation is not out of place.

We have briefly considered :

1. The structure and functions of the human body.
2. The need of proper food, proper air, proper movements and for proper cleansing has been specified.
3. We have passed in review the more conspicuous results of improper feeding, of improper breathing, of improper and of insufficient movements, and of improper and of insufficient cleansing.
4. We have seen how chronic disease may be caused by constant violation of the laws which govern the maintenance of health.

Before going further, it will be well to emphasize once more what has already been said in one respect, which respect continually arises between the physician and his best work, through the inability of the patient to understand it. I have referred to the fact that in

such protean results as arise from chronic ill-health, the "surface expression" may not *in the least* indicate, to the unskilled, the real source of the mischief. The trouble complained of is often of very gradual and insidious growth in many cases, and such sufferers will constantly be found to stoutly deny that they have any trouble with their digestion, whereas it frequently is really at some point in the digestive and assimilatory function that the mischief has taken root. Take, for instance, many sufferers from asthma. Their whole attention is directed to their lungs. But reform the digestion, and the suffering is relieved. Take again, many cases of joint trouble, *e.g.*, Rheumatoid Arthritis: who among the unskilled would say that without other medicine than a slight aperient and with the closest attention to diet and to nutrition, their joint-pains, sleeplessness and other typical symptoms will often be relieved, as it were magically? yet such is the case. Thus it is that those common factors of health, those processes the proper performance of which lies at the root of all healthy vital activity, must be carefully regulated and supervised.

Having covered these grounds, we are now in a position to consider how health, once upset, may best be regained.

The causes of ill-health.—Clearly, the first thing to do, is to stop the causes which lead to ill-health, once these can be determined. It would be the height of folly merely to tinker at the surface expression: to try to cure neuralgia in the head, let us suppose, by local injections of cocaine. The *cause* of the neuralgia must be discovered, and the *cause* must be removed.

Causes of pain remote.—It is no use, save under special circumstances, to cover up a diseased symptom under a cloud of anodyne. The pain is a symptom which draws attention to a state of disease; remove, therefore, the state of disease and the pain will cease permanently. But, as a rule, the causes of pain as a symptom of chronic disease, are considerably remote. The slight transgressions of the laws of health do not entail many, if any, consequences to the transgressor, unless they are repeated, and many times repeated. So great is the effort of nature to retrieve and to adjust matters, that the evil day for the transgressor is indefinitely put off and may, indeed, in many cases only become manifest as the apparent result of some acute illness which acts as the determining cause. Many people will deny that they have indigestion, simply because they have never had any pain in the stomach. Many will only complain of lassitude, weakness or headache, and are incredulous even when the clearest evidence shows that they suffer from a dilated stomach. In children, when acute pain in the knee is complained of, the cause, in very large numbers, has to be sought in the hip-joint. A more notable example still is the complaint of agony in the toes from a man whose leg has been amputated.

But however remote, the causes of given symptoms of pain and disease must in most cases be sought and will be found in those infractions, slight, it may be, at the commencement, but cumulatively great in their gradual perversion of nutrition—of the laws of health.

Diagnosis.—Most careful diagnosis is necessary, because :—

In these cases the more evident symptoms are quite as likely to mislead as instruct. The only sure test is by the microscopical and chemical examination of the blood, of the urine and the fæces.

Unfortunately, this test is not always applied. And yet, in a sense, physiologically as otherwise, it is not only that which entereth into a man, but that which goeth out (or which fails to go out), which defileth him. And without thorough examination of the urine and fæces it is impossible to determine the following points, viz :

The condition of the alimentary and kindred organs ; or,

The effect of the foods upon those organs ; or,

The effect of the various organs upon the foods ; or,

The blood-making power of the alimentary canal as a whole.

Nor is it possible, without a microscopical examination of the blood, to determine the connection between its condition and the evident symptoms—and we may be sure, remembering the facts we have already reviewed, that the condition of the blood will have a most important bearing upon the evident symptoms as well as upon the cause itself. It cannot be said that the condition of the blood *is* the cause, for the

underlying cause in most cases, is to be found in some violation of the laws of health.

Value of such examination.—Vital to successful treatment as this method of examination and of diagnosis is; safe and certain as are its results when experience has taught the practitioner how to interpret what the microscope reveals and what chemical reaction suggests; it is only the physician who is also a scientist who can hope to follow this method with advantage.

Only useful to the scientific physician.—Amateur work is worse than useless, for the amateur will be unable to synthesize the various results of his examination.

Unity of contradictory phenomena.—And, however important the preliminary analyses may be, it is the final synthesis that reveals the underlying unity of what at first sight may appear to be contradictory phenomena.

Specific gravity of urine may mislead.—For example, the specific gravity test of the urine can only indicate possibilities. Taken alone, it is useless. If the specific gravity of the urine should prove to be 1.040, this may be an evidence of a diabetic tendency; but the same phenomena may be due to an excess of nitrogenous waste—an opposite development. Other tests have to be employed, and then the general result must be interpreted in the light of the practitioner's experience. After the exact condition of the blood and of the organs has been determined, and the connection between that condition and the evident symptoms has been traced, search must be made for

the underlying cause, which, as I have said, will generally be found in some violation of the laws of health.

Need for special and distinctive treatment of individuals.—Errors in eating and drinking, in breathing and moving and cleansing, must be rectified ; while special methods of feeding, breathing, exercising and cleansing must be prescribed for, and *carried out by the patient*, in order to counteract the effects of the wrong methods which have induced ill-health.

Patient must co-operate.—

The patient must loyally co-operate. And of course the special feeding and so forth must depend quite as much upon the physical and mental peculiarities of the sufferer as upon the nature of his disease.

No two organisms alike.—

There are not two organisms in the world that will act absolutely alike in the presence of identical conditions. Nor can any one organism be relied upon to act to-day exactly as it acted yesterday. Hard and fast rules must be avoided, as being likely to prejudice the directing mind, and to deprive it of the power to constantly readjust the treatment, in so far as may be necessary, in response to new developments: every patient should be treated separately, distinctively, and, as it were, by his own light, cast upon his case to the scientific eye.

The aim of the treatment.—The special feeding, breathing, exercising and cleansing will have in view:

(*a*) *The removal from the body of all injurious matters, such as waste products and ferments, whether these be due to microbic or other action.*

(*b*) *The reconstruction and building-up of the system.*

So much has already been said in these pages concerning the nature of waste matters in the body and their injurious effect, that it cannot at this point be necessary to enlarge further upon the subject. We have simply to consider how they can best be removed, for reconstruction cannot take place properly until the foundations of the human temple have been cleared of all *débris* and dirt.

Preventive measures.—Even before this is done, steps must be taken to *prevent further accumulation of waste matters.* Foods which are not necessary to the preservation of health and which have been instrumental in producing waste, must no longer be taken. Organs which are diseased and which are therefore likely to turn even proper food into poisons (and these poisons are some of the waste matters in question), must be given a thorough rest.

Starches, sugars and fats chiefly mischievous.—Now it happens that in the majority of cases, as we have seen, it is the starches, sugars and fats which are responsible for the mischief; it is their fermentation or imperfect assimilation which has blocked the organism with refuse. In consequence of this both the stomach and the intestines may be diseased and may require rest; but fortunately it is possible to rest the stomach

while still working it, for the right sort of work will not hurt anything.

Stomach tired by fermentation.—It is fermentation that has tired the stomach and that has made it unfit to deal with fermentable foods.

Need of rest for intestines; how attained.—Stop the supply of these foods; maintain—and increase—the strength of the body by a plentiful supply of lean meat, *properly prepared*, and the intestines will get a thorough rest, while the stomach will only have to deal with food which it can absorb directly into the system without fermentation or other disturbance. The stomach, as previously explained, can, if necessary, be washed and cleansed of any lingering impurities.

Absolute rule impossible.—It is not possible to lay down an absolute rule, and to say that starchy and saccharine foods are always to blame for diseased conditions of the digestive tube. But quite apart from their liability to ferment, and so to clog the liver, and to form superfluous deposits, it is only by abstention from these foods that the intestines can be completely rested, and that the work of the stomach can be reduced to a minimum. And physiological rest works wonders. If a limb be fractured, rest permits union to take place; if there be cerebral congestion, inactivity of the brain will permit repairing of the damage. Rest enables nature to regain her equilibrium. It is our work to assist nature to react and to heal her own parts.

The removal of wastes.—It is not sufficient, however, to rest the digestive organs and to stop the further accumulation of waste matters. Waste matters

already accumulated must be removed. This process might be compared, in a homely way, to the removal of "fur" from the inside of a kitchen-boiler or kettle. To accomplish this, the excretory organs must be invigorated and the circulation of the blood must be improved. Both of these important ends may be attained, while the waste matters removed may be replaced by proper material, by means of Motion. This subject will be fully dealt with in a subsequent chapter.

CHAPTER XV.

SOME HEALING MODES OF MOTION.

Motion.—Some 600 years B.C., a wise old Chinaman is reported to have said: "May not a man take a dead thing and make it alive by continuous motion?" More recently, in the early part of the eighteenth century, Hoffman, in his *Dissertationes Physico-Medicæ*, took for the heading of one of the divisions of his work the statement that "Motion is the best means of cure for the body."

Energy.—Energy, or what is called potential energy, lies stored up in every known form of matter. This potential or latent energy, may be made active by supplying the proper conditions. Activity induces activity.

Modes of one energy.—Physical science asserts that the phenomena with which it deals are different modes of one energy; that heat, light, electricity, magnetism, etc., are but different manifestations of this single force, or Motion. These apparently different forces are really convertible into each other, given the necessary conditions. Many authorities assert that vibrations of colour and of sound are also modes of this

same basic Motion. Chemical energy is admittedly but another of its manifestations.

A mental picture.—It will be well, then, to form a mental picture of this one and universal Motion, manifesting itself differently according to the nature of that through which it manifests ; now expressing itself as chemical energy, that converting itself into electricity, that into heat, and so forth. First potential or latent, then kinetic or active ; never diminished in quantity or power, but only transformed.

Experiment with sulphuric acid.—A simple experiment will help us to realise the truth of this conception. Get some dilute sulphuric acid. Place in it a piece of copper and a piece of zinc. The zinc will gradually dissolve. Here we see chemical action. Now, if a copper wire be fastened to that end of the piece of zinc which stands out of the liquid, and if another copper wire be fastened to the corresponding end of the piece of copper, electricity will be manifested. Unite the unattached ends of the copper wires and the temperature of the wires will be increased. Here we have heat. If a third wire, connected with the other two, be wound upon some soft iron, the iron will become a magnet and will attract iron shavings and so forth. Here we have magnetism. Physiological action may be obtained by applying the unattached ends of the two copper wires to a muscle and nerve of a frog that has been recently killed. Chemical action may again be obtained by placing the unattached ends of the wires in acidulated water, which will then be decomposed into hydrogen and oxygen.

Motion applied to the body.—Keeping in mind, then, that apparently different forces are in fact but different modes of one and the same force, and that these different modes can be converted one into the other, the effect of any sort of motion upon the body will more readily be understood. Motion applied to the body provokes movement on the part of the body, and on the part of the molecules of which the body is composed.

Too much force kills.—In this connection it will be well to remember that too much force of any kind kills, just as too much food kills. Too much heat, too much electricity or magnetism, too much chemical action or physiological activity, and even too much life—kills.

Three modes of force.—This well known fact will help us to understand another fact less well known, namely, that every force can act :—

(*a*) As a constructive force ;

(*b*) As a preservative or equilibrating force ;

(*c*) As a destructive or dispersing force.

According to the mode and measure of its activity, each of these three modes of force can be used in the recovery of health.

Example of constructive force.—Now we have seen that the blood breathes oxygen in the lungs and supplies it to the tissues ; that without oxygen combustion is impossible and the tissues die, just as the body dies if the oxygen in a room becomes exhausted. It has been shown that, just as without motion the lungs cannot inhale the oxygen in the air, so without

motion, the tissue cannot partake of the oxygen in the blood. From a slightly different point of view, it is as if the little red corpuscles, laden with fuel, were to find the furnace doors closed against them as they hurry through the body ; the tissues being sealed to them for lack of the movement or friction which alone creates a demand for that which the corpuscles supply. But motion of the tissues will both enable them to breathe and will liberate the oxygen which the corpuscles carry. Here we see the constructive and equilibrating effect of motion.

Example of destructive force.—Carrying our thought one step further, it will be clear that just as when the lungs lose their power to inhale oxygen they also lose their power to excrete waste matters such as carbonic acid gas ; so, when the tissues lose their power to partake of the oxygen of the blood, they must also lose their power to excrete waste matters. Without motion, then, wastes accumulate —deposits are formed, stiffening the joints, blocking the passages in the tissue, and setting up decomposition and decay. But *motion* of the tissues, by restoring their power to absorb oxygen, restores their power to excrete. In other words, motion removes wastes or converts them into a soluble form. Here we see the healthily destructive or dispersive effect of motion.

Best means of applying Motion.—It should by now be evident how vitally necessary to the recovery, as well as to the maintenance of health, is motion in some form or another. Motion may be obtained in many ways, just as it may express itself in many different modes, as electricity, as heat, as physiological

activity, and so forth. It may be obtained by internal and by external means, of which the following are probably the best :—

1. By washing the external skin and the "skin" of the alimentary canal ;
2. By deep breathing ;
3. By exercising the muscles and the joints, (*a*) actively, and (*b*) passively ;
4. By the application of heat and cold ;
5. By the use of chemicals.

It will be found that the above ways of applying motion have a three-fold action : while dispersing wastes, they tend to re-establish physiological equilibrium and to reconstruct diseased parts.

Washing of the surface skin.—The surface skin is, as said, an organ by which certain waste materials are passed from the body. By way of the sweat- and sebaceous-glands, if not by direct transmission, moisture, gases, acids and other materials are brought to the surface. Their removal from the interior of the body is thus effected, but it is also essential that they shall be removed from the surface. It is clearly of importance that the ducts shall be kept open, and many know the relief afforded by a good perspiration. If the "pores" are not kept open and the oily sebaceous matter is kept penned up, there will very probably be a large number of "blackheads." There must be a natural action and reaction between the surface of the body and its surroundings. Those who choke the skin with pigments or ointments, or who fail to properly cleanse

or wash it, cause it to fail to do its excretory work, and are more or less poisoned by this failure. This is the general rule, although the constituents excreted by the skin vary ; one person may have a very acid perspiration, and the varying odour of the perspiration is familiar to most. Turkish and vapour baths are most useful in promoting the action of the skin, and by so doing they relieve the system, the dead and useless cells of the outer skin being also removed. The process of excretion is thus made easy. The hot dry air baths and the radiant heat baths constitute most valuable aids in the recovery of health.

Washing the internal skin.—The body should also be washed *internally* by increasing the fluidity of the blood, and of the lymph. This enables them to pass more freely through the capillaries and lymphatics respectively, and by improving the circulation tends to wash away the material which should be excreted.

Value of Spas.—The value of the various Spas and mineral waters is a proof of this. The value does not merely depend upon the minerals dissolved in the water. These minerals, it is true, have a definite solvent effect in the body, whether they are drunk or absorbed into the body by the skin. But the main essential is the quantity of fluid which favours the circulation as above stated, and in addition the hygienic regulation of the habits of life, which is made of paramount importance at most of these Spas.

Hot water and urinal flow.—The fluidity of the blood and the lymph may be increased by the in-

ternal use of simple hot water. A few minutes after a quantity of hot water has been drunk there will, in ordinary circumstances, be an increased flow of urine. Some people vaguely imagine that the water has passed directly into the bladder, but the fact, of course, is that the first flow of urine which follows the drinking of the liquid is produced by pressure of the liquid just taken upon the blood. The blood, under this pressure, seeks an outlet and acts upon the kidneys. The kidneys then secrete from the blood the fluid known as urine. After this first flow, there usually follows another of a lighter colour than the first. It will consist very largely of the liquid that has just been drunk.

The path traversed by the hot water.—This liquid, however, will have passed through the stomach and intestines, the portal vein, the liver, up to and through the heart and lungs, and thence, by way of the aorta and the arteries connected with the kidneys, through the kidneys into the bladder.

Results of hot water.—It will have tended to sweep away with it the waste products which have accumulated in the small capillaries and in the lymphatic ducts, and which have been deposited upon the sheaths of the muscles and the nerves and in the joints. It will have washed out the liver and will have made the bile more fluid. The hot water will also tend to wash away any superabundance of mucus secreted by the mucous membrane of the stomach, of the intestines, and of the digestive organs generally.

Hot water as a stimulant.—Finally, its heat will act as a stimulant to all parts of the body, particularly

to the nervous system. It will thus promote physiological activity, which is a form of Motion, and a vastly important form of Motion in view of the end before us.

Hot water at meals a mistake.—It is a great mistake to take the hot water at meals, except in small quantities. To do so not only dilutes the gastric juice, but, if taken in excess, is liable to wash food from the stomach before the gastric juice has acted upon it at all.

When and how to take the hot water.—The hot water must be sipped, so as not to tend to dilate the stomach, and it should not be mixed with anything unless specially so directed. It should be taken at least an hour before breakfast, so as to prepare the stomach for the reception of that meal. It should also be taken the last thing at night, or not sooner than three and a half to four hours after late dinner, so as to wash out the stomach before sleep, and thus prevent retention and fermentation during the night. In three and a half to four hours the gastric juice will, as a rule, have had ample time to do its work satisfactorily. When hot water is taken as part of a specific treatment, a pint before breakfast and the last thing at night is not sufficient. It should be drunk from three and a half to four hours after each meal as well, and the hours for meals should be arranged so as to make this possible.

Very hot water constipates; tepid water relaxes; cold water, an aperient.—Very hot water is constipating. Tepid water is relaxing. Cold water (a glass), is often used as an aperient; it acts as a

shock and so stimulates peristaltic action. Hot water, when taken as prescribed above, should be at about the temperature at which people ordinarily drink their tea, that is about 120°—130° F.

Proper effects of hot water.—The effects of hot water properly taken and combined with the use of a proper diet are:—

1. Increase of appetite.
2. Improved digestion.
3. No discomfort after meals; disappearance of flatulence, heartburn and sourness of stomach.
4. Decrease of fat and (later) increase of muscle and tone.
5. Skin has a healthy reaction and begins to act properly.
6. Disappearance of disagreable smell of evacuations.
7. A sense of elasticity commences and a feeling of being equal to any of the emergencies of life.

Such are the effects which may be noticed by the patient, but the skilled physician can also observe:—

1. The blood: Stickiness is got rid of and the corpuscles circulate, retaining only the necessary adherence; Excess of fibrin is removed; The platelets are diminished and the spaces between the corpuscles are clear, bright and no longer hazy and "dirty"; The corpuscles assume the contour associated with healthy blood and their biconcavity becomes more

marked ; Their edges are no longer blurred, but are sharply defined.

2. The urine becomes healthy and no longer presents abnormal constituents, whether chemical or microscopic.

3. The fæces become healthy and show a perfect digestion of food, absence of irritation and healthy tone of the bowel, both secretory and motor.

Breathing.—In a previous chapter we have gone fully into the first of the above modes, the washing of the two "skins." We have now to consider how to promote physiological activity by special movements of the lungs. Breathing exercises should be performed. By this means the capacity of the lungs will be increased. The blood will be thoroughly oxygenated and its circulation and activity improved. Consequently, as we have seen, combustion will more readily take place, and waste matters will be consumed or will be converted into more soluble form and so removed.

Breathing exercises. — These special breathing exercises should be performed before breakfast, in some room in which the air is fresh or before an open window. The hands should be raised slowly until they extend straight above the head. The two thumbs should then be locked. While being raised the lungs should be filled slowly with air, so that, by the time the hands are fully raised, the lungs will be expanded to their full capacity. Holding the breath in the lungs, the arms, kept stiff and straight, should then be lowered slowly towards the feet and should

be forced down as near the feet as possible. This will curve the back and give the body the appearance of an inverted U. When the arms can reach no further, the air in the lungs should be slowly expelled. Then, after a second's pause, the hands should be raised slowly again and the exercise repeated as before. As soon as there is a sense of fatigue, a couple of minutes' rest should be taken, and then the exercise should be again continued.

The refreshing effect of this exercise will be felt throughout the day. The body will feel more "alive" than it has probably felt for years. Besides the immediate effect of oxygenating the blood, the liver will have undergone a natural massage by pressure between the diaphragm and intestines—a very important and useful result—and the muscles of the back and chest will have been developed *from within outwardly*.

A warning.—The significance of those italicised words may not at first sight be appreciated. They imply that mere muscular exercises "to expand the chest," without regard to proper breathing, are likely to do more harm than good. They tighten and harden the muscles, converting these into so many "bands of iron" to confine the chest and lungs. They are not used to increase the "vital capacity," save indirectly. The result is that development has taken place from without to within, from circumference to centre, instead of by expansion from within, outwardly. Develop the lung capacity first, and the strengthening of the muscles of the chest will follow naturally and without further effort. Hard muscles are neither a proof of

strength nor of health, in spite of the common superstition to the contrary.

Gymnastic controversy.—In addition to this specific exercise, care should be taken to breathe properly throughout the day. Slow, full breaths should be taken whenever opportunity offers. A distinct effort should be made to affect the "stationary" air.

Here a word may appropriately be said in regard to the controversy which has been waged by certain "professors" of physical training as to the relative value of breathing from the diaphragm or from the top of the lungs. One school maintains the value of the one method; another of the other method. "Common sense," apart from "schools," would suggest that the object of breathing is to fill the *whole* of the lungs with air, and that in the case of an individual whose lungs are poorly developed, either at the top or at the bottom, a special effort should be made to develop them evenly. Weak spots are always open to attack. As a general rule, men breathe more from the diaphragm than women; women more from the top of the lungs than men.

Tight-lacing is largely responsible for the peculiarity in the breathing of women; but whatever the cause may be, the remedy is simple: to breathe so as to fill the lungs completely, using all parts of the lungs evenly and equally.

Active Muscular Exercise.—Unfortunately, it is not always possible for sufferers from chronic disease to take active exercise. Whenever it is possible, it is of the greatest help in effecting a cure. Out-of-door exercise, regularly taken, is preferable. Moun-

tain climbing, horseback riding, rowing, lawn tennis and field games, all in moderation, exercise not only the muscles and joints, but the lungs as well. Such exercise, as a most comprehensive form of motion, oxygenates the blood, improves the circulation, increases combustion, renders waste matters soluble, and does more than anything else to remove them.

Indoor exercise.—Failing active exercise out of doors, indoor exercise is sometimes possible. Swedish movements and the ordinary gymnasium will supply this, but such exercise may also be obtained at home, though not so perfectly.

The true object of exercise.—It should always be remembered that the true object of hygienic exercise is not that of hardening the muscles, but is to exercise them *all*, and to exercise all equally. A man may have an immense biceps and yet be thoroughly lacking in muscular tone. Every other muscle in his body and all his joints may be choked with poisonous waste products.

Some hygienic exercises.—One of the best ways in which to obtain indoor exercise is to combine certain muscular and joint exercises with the breathing exercise already described. The first thing to do is to learn to stand properly, with the head erect and the shoulders flat—not pressed backward. Standing thus, raise the heels slowly, pressing the ground with the toes. Repeat this movement for several minutes. Then holding the arms flat against the side, bend the knees and lower the body towards the heels without actually touching them ; raise the body again, keeping the

back straight and upright and not allowing the hands to touch the floor.

Next, holding the hands one on each side of the waist, keeping the shoulders as flat and stiff as possible, and the legs stiff and straight, bend the upper part of the body far to one side, and then, to that angle, endeavour to move it round in a circle, the centre of which will be the waist. The effect will be to bend the body from the hips, forwards, backwards and sideways ; but by doing this circularly in the manner described, far more muscles are brought into play. This movement will exercise the abdominal muscles particularly, will free the hip joints, and will improve the circulation of the blood in and around the digestive organs.

Next, filling the lungs full of air and holding it there, with body and head erect, raise one arm forcibly above the head while the other is held close to the side. Then lower the raised arm and, while doing so, raise the other. Continue this movement vigorously, raising one arm while lowering the other, until it becomes necessary to expel the air from the lungs. After slowly refilling the lungs, repeat the movement. This exercise has been called "the liver squeezer," because of its stimulating effect upon the liver.

Next, while holding the lungs full of air, and with body and head erect, extend the arms as in swimming, bringing the shoulders well back at each movement. This exercise is useful, but may be omitted if time presses.

Next, to increase the breadth of the shoulder measurement and to strengthen the top of the lungs, stand

upright and with head erect, in such a way that one arm extended so as to be parallel with the floor, can just touch the wall. Having assumed this position, move the feet an inch at a time away from the wall, and, while keeping the legs and lower part of the spine erect, stretch the arm and shoulder so as to keep the tips of the fingers continuously in touch with the wall. Repeat these movements with the other arm.

Then, to exercise the muscles of the neck and to give tone to the bronchial tubes and to great arteries and veins running through the neck, turn the neck around slowly, from side to side and as far back as possible, while keeping the shoulders and the rest of the body perfectly straight and stiff.

Incidentally, it may be asked, why stress is laid upon the need for keeping other parts of the body straight and stiff while particular muscles are being exercised. The reason is that most people use but a small proportion of the muscles, and when called upon to make a movement, will use the wrong muscles in doing so. Thus, instead of turning their head by means of the muscles of the neck, they will turn their shoulders and twist their abdominal muscles, leaving the muscles of the neck unused. If called upon to pick something up from the floor, they will bend their knees and will curve their spine, but will not use the central pivot of the body, the hip-joint at all. Why? Because the hip-joint is stiff and it hurts them to use it. This stiffness is due to lack of exercise. Stiff joints are the very ones that most need exercise, and in ordinary circumstances they get the least exercise of any. Hence the importance of keeping the other

parts of the body still while particular muscles and joints are being exercised. Stiff joints and weak (because unused) muscles, in which the blood circulates feebly, are centres of irritation and decay ; for it is in just such places that the waste matters of the body are almost certain to accumulate.

Finally, continuing the exercises ; lie down flat on the floor, with the arms extended straight on either side of the body without their touching the floor. Then slowly raise the upper part of the body until a sitting posture is attained. Recline once more and repeat the movement. When this can be done with facility place the hands at the back of the head and then raise the upper part of the body as before. Both these movements afford magnificent exercise for all the abdominal muscles. The appetite for breakfast will be astonishing! Better than that, the digestive capacity will be greatly increased, and while healthy waste will be created, the accumulation of unhealthy wastes will be removed. But this book will have been read thus far in vain, if it be necessary to further emphasize the need of moderation and care in the use of these exercises at the start. Stop when fatigued : better still, before fatigue is really felt.

Passive exercise.—Unfortunately, as I have said, it is usually in the early stages only of chronic disease, that active exercise is possible : the physician is therefore obliged to fall back upon what have been described as passive exercises. These include the application of electricity and massage.

Massage.—Massage is motion applied externally. It may be compared to the squeezing of a sponge,

and its after effects can be likened to the healthy reaction of the sponge as it springs back to its original proportions minus the matters which filled its cavities. When a patient is unable to move for himself, healthy movements may in this way be induced. Massage will not take the place of self-induced movements, but it will supply exercise of the tissues in a concentrated form.

What massage will accomplish. — Massage will accomplish the following results :—

Increase of circulation and removal of waste matters;

Absorption of infiltrations and exudations in organs that can be reached from without ;

The molecular vibrations which it sets up produce healthy changes in muscle and nerve-fibres ;

Adhesions in joints can be separated, and any congestion in internal organs, such as the intestines, lungs, kidneys, and brain can be relieved ;

Stimulation of the sympathetic nervous system and consequent increase of healthy secretion of the glands connected with the alimentary system.

Electricity. — Although massage when properly applied is a safe and most useful means of inducing motion by motion, there are certain minor inconveniences connected with its employment which, in some cases, make electricity preferable as a remedy. For electricity, as another mode of motion, will do all

that massage can do, and some other things as well; though in many cases the combined use of massage and electricity will produce the most satisfactory results.

Electricity is in no sense foreign to the body. All nervous activity is accompanied by electrical phenomena, as can be shown by the use of a galvanometer.

Experiments have shown that subjects who have been unable to hold a given weight at arm's length for more than a few seconds, could hold the same weight without discomfort for several minutes after a current of electricity has been passed down the arm. The force, as well as the endurance of muscle, can be increased in the same way.

Some of the results of electricity as a remedy are as follows:—

It stimulates the muscles, both directly and through reflex nervous action;

It acts upon the sensory nerves, and in this way upon the central nervous system;

All living tissues are stimulated by electrical treatment;

The glands of secretion are made more active;

The peristaltic movement of the muscles of the stomach and intestines (unstriped muscles), are increased; this greatly assists the excretory processes, while even without muscular contraction the elimination of urea and of carbonic acid may, by this means, be most markedly augmented.

Static, galvanic and faradic currents.—The static the faradic, the galvanic and the galvano-faradic currents are all of them modes of one force. The

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effect of each of these currents upon the organism is different.

The galvanic, the faradic, and the galvano-faradic currents, will stimulate the tissues and clear out waste matters by dilating the blood-vessels and increasing the circulation ; or by causing muscular contraction and squeezing both the blood-vessels and lymphatics. Of these currents, the galvano-faradic is particularly effective in relieving pain, in promoting nutrition, and in restoring function.

The static current.—Static electricity is of immense help in aiding nature to restore her equilibrium, once this has been lost. A medical committee once reported that static electricity "sets free the potential energy of the cells of the human organism. That is, it excites the cell in such a way that its inherent energy is liberated." It tends to regulate functional derangement ; to restore balance and tone. Thus, if the beat of the heart be too slow, static electricity will increase it ; if the beat of the heart be too rapid, static electricity will reduce it to a normal rate. It restores normal action, and readjusts respiration, oxidation, circulation, secretion, excretion, the temperature, nervous irritability and sleep, once these processes have been disturbed. By the proper use of the static machine, a molecular change may be brought about which acts as a stimulating massage, and in this way the nutrition of the whole organism may be greatly improved, as also the nutrition of a part, while absorption may be promoted, thickening of joints and muscles may be reduced, and wastes may be removed. Static electricity will furthermore suppress movements that are injurious or useless.

Heat and cold.—Both heat and cold are modes of Motion. We have seen, under the head of "Motion," that electrical activity can be utilised as heat. Heat, up to a certain point, is an expansive agent ; cold, up to a certain point, is a contractive agent. The treatment of an ordinary sprain will help the reader to understand the application of heat and cold in other and more serious disorders. In the case of a sprain, hot water is applied first in order to induce a rush of blood to the part, and thus, by increasing the circulation, to remove the effusion of fluid in and around the joint. Later, cold water may be used with advantage in order to drive the blood away from the part and so to reduce the inflammation. For heat will always draw blood to a part, while cold will always at first drive blood away from it, *plus* the materials which the blood has taken up in its passage. It will readily be seen that this principle is capable of wide application, and that hot and cold baths, taken alternately, Turkish baths, and the local application of heat and cold, are all means of inducing healthy, healing motion by means of motion, which, in some cases, though not in all, the physician may use to effect the desired purpose.

Hence the various hydropathic measures, the hot and cold douches, the hot, tepid and cold packs, the needle-spray, affusions, bandages, dripping sheets and baths—the Kneipp treatment—all are based on the action and reaction of the circulation, and in numbers of cases can be used with most beneficial results in the work of aiding nature to restore her balance of health.

CHAPTER XVI.

DRUGS: THEIR USE AND ABUSE.

The use of chemicals; a distinction.—Chemical action, as we have observed, is but another mode of Motion. Even so, a distinction might be drawn between :—

(*a*) The use of certain chemicals as drugs; and

(*b*) The use of certain chemicals as foods.

Chemical elements of the body.—Now the body is composed of certain chemical elements, variously combined, such as hydrogen, carbon, oxygen, nitrogen, sulphur, iron, phosphorus, chlorine, potassium, sodium, calcium and so forth.

Chemicals as foods.—We have seen that milk, meat, wheat and nearly all the ordinary food-stuffs, contain these chemicals in various proportions. These chemicals, then, in any case, may be regarded as foods rather than as drugs, seeing that they not only enter into the constitution of the body, but also make up the ordinary foods upon which we live. Consequently, for the same reason that we take food, it may become necessary to replace existing constituents of the body, or to add certain constituents which are

lacking, by means of such chemicals as iron, soda, potash and so forth. But it must be remembered that, like food, these chemicals must be digested and assimilated.

Chemicals to remove wastes.—So, when it comes to removing the waste matters of the body, which might be compared to thickened oils which clog the working surfaces of the bodily mechanism, there are various natural solvents which may be used with perfect safety and with sure effect. They may be used so as to act directly upon these wastes, or so as to convert them into a more soluble or removable form.

Other uses of chemicals.—These and other chemicals will cause an increased supply of blood to the organs and muscles; or will promote a more profuse action of the skin; or will augment the secretion and excretion of the liver and kidneys—according to the nature and quantity of the chemical used.

Chemicals are not specifics.—The following fact, however, should always be remembered:—

Medicines of themselves can never cure; they can only assist in making a cure possible.

Medicines may form an efficient part of a system of treatment: allies, more or less helpful of the "*vis medicatrix naturæ.*" In certain cases they provide a short cut towards a cure; in other cases they act as a stop-gap by hindering bad developments until the natural and healthy action of the organism has been re-established; but at best they can render only temporary assistance.

Indiscriminate drugging.—And now that I am dealing with the use of chemicals, I should like to raise a note of warning against their abuse. There are several forms of abuse of drugs, and one quite common form is the taking of "general prescriptions" such as are given in some books on medicine; for not only is it true that what suits one patient may kill another, but the size of a dose that will affect one person favourably may affect another disastrously, according to the age and the constitution of the sufferer.

Patent and widely advertised medicines, though sometimes proving excellent remedies, are objectionable for this, if for no other, reason: the sufferer cannot possibly be sure of the right quantity to take, for a general prescription may be worse than useless for his particular constitution.

A foolish practice.—Another foolish practice is to take a physician's remedies, and at the same time to take "simple home remedies"; and even old prescriptions, suited to an earlier period and bodily condition. Such things are done. I have heard of cases in which patients have been treated by one physician and have at the same time taken privately some powerful remedies prescribed years before by some other physician, because "they proved so helpful then." Yesterday is not to-day; bodily conditions are all the time changing, and, with these, the very elements of the body. I have heard of other cases, even more extravagant from one point of view, in which a patient was taking remedies prescribed for friends whose symptoms (pains), were supposed to be

similar to his own; and, while doing this and keeping his own physician in ignorance of his action, this patient was at the same time taking the remedies prescribed by that physician with almost religious fervour. I have also known, absurd as it may seem, of members of a family taking the remedy successfully prescribed for another member who had *seemed* to have the same trouble earlier. In view of what has already been said of the inability of the sufferer to judge of the cause of his trouble, the folly of such courses may be seen. Who would transact any of the business affairs of life in this haphazard, happy-go-lucky fashion? The root of the trouble in this respect is that people are so uninformed of the simple facts of physiology, that they have not yet come to understand what their bodies are nor how they should be treated. Quite apart, too, from other considerations, there is in such cases always a danger of over-dosing by the same drug and a lurking possibility that one drug may neutralise another. Even when the results are apparently good ones, it can never be known what subsequent troubles have not sprung from this course.

One absolute rule.—One absolute rule may be laid down with perfect safety:—

It is better to take no medicines at all, than to take the wrong ones; or to take the right ones in wrong doses.

Chemicals are good servants if properly used, but if misused, they are apt to call the entire bodily economy out "on strike."

Holding the opinions that I do on this subject, it

is naturally very far from my intention to offer "general prescriptions," particularly as what I now have to say is addressed to the public, rather than to the profession.

The purpose of chemicals.—But although the use of chemicals, whether as foods or as drugs, is a department of the recovery of health in which the patient should not attempt to help himself, except by adhering faithfully to the prescriptions of his medical adviser, it is important that the *purpose* of chemicals should be understood, whenever possible, so that the patient may co-operate intelligently with the physician. With that in view, it may be well to deal briefly with the action of one or two of the chemicals that are especially useful in cases of chronic disease. Among those which I have ventured to classify as foods are :—

Bicarbonate of soda.—It stimulates the flow of the gastric juice. Being alkaline, it tends to liquefy sticky mucus and to neutralize over-acidity of the contents of the stomach, though in some cases it excites a more copious secretion of that acid—hydrochloric—which is so necessary to gastric digestion. It increases the activity of the kidneys and diminishes any acidity of the urine. Its effect on the bowels is slightly laxative.

Phosphate of soda.—It acts more directly upon the liver, rendering the bile more fluid and enabling it to flow more readily from the liver into the intestines. In this way it may act as a purgative. Like all forms of soda, it acts as an alkaliser of the blood, neutralising acidity wherever present.

Sulphate of soda.—This is a constituent of Friedrichshall, Hunyadi Janos, and other waters; it is a fairly powerful purgative, producing an abundant, watery evacuation. It acts chiefly upon the bowels.

Nitre.—This promotes both the action of the skin and of the kidneys. increasing, in this way, the loss of heat from the skin and tending to lower feverish conditions.

Ammonia.—This acts as a general stimulant. *Acetate of ammonia* affects the skin and the kidneys very much as spirit of nitre affects them. *Carbonate of ammonia* increases the secretion of the bronchial tubes, rendering this more liquid and more easily raised. The acetate and the carbonate together may frequently be employed with advantage in bad colds and coughs.

Sal Volatile.—This is another form of ammonia. It acts as a general stimulant and, moreover, has, like soda, a markedly antacid effect upon the contents of the stomach. It also increases the secretion of the gastric juice.

Nitrites and Nitro-Glycerine.—Among other chemicals, which cannot be classified as foods because they do not replace or add to the existing *constituents* of the body—though they produce *effects* which tend to enable the parts of the body to function normally—are the *Nitrites* and *Nitro-Glycerine*, which may be used at times to drive the circulation of the blood from the centre to the periphery and so to relieve the heart.

Quinine. — This is a combination of nitrogen, oxygen, hydrogen and carbon in certain proportions.

In small doses of from one half to two grains, it stimulates the circulation, and improves the appetite and digestion by increasing the flow of saliva and of the gastric juice, and by promoting evacuation by the bowels. In larger doses of about ten grains, the effect of *Quinine* is very different. It suspends the molecular activity and thus diminishes the production of heat in the body. It may be used in fevers, in neuralgia and in kindred disorders.

Iron.—This enriches the blood and promotes its oxygenation. It should be administered with care, however, on account of its tendency to constipate the bowels.

Calcium (lime). This is a valuable astringent in diarrhœa. It has an antacid effect upon the contents of the stomach and diminishes the excretion of water in the bowel; and, in certain cases, is useful in preventing hæmorrhage.

Phosphorus.—In the form of *Hypophosphites of Sodium*, it is sometimes prescribed in cases of nervous and general debility and in chronic lung disease. Its action is complex. It favourably affects the bones and the lymphatic glands.

The Hypophosphites of Lime, Iron and Manganese, and the Phosphates, are often used in various "Chemical Foods."

Points of experience.—These are but a very few of the weapons in the hands of the man who can use them. They, like others, are powerful agents in the relief of symptoms, and are of value in replacing certain constituents of those foods, of which it may be necessary to deprive a patient for the time being.

Every case must be treated on its own merits, and no one general rule can be given save that mentioned earlier. To restore the balance of health by the proper use of food, drink, air, exercise and bathing is best of all. But in that restoration it may prove that an organ which is out of working order may with advantage be stimulated to action until its function has become natural owing to hygienic measures, and until that function has become properly interactive through restoration of motions. Also it may be necessary to assist assimilation by an addition of those constituents of food which, if only contained in food, would entail the consumption of such food in too great an excess. I shall have gained my purpose if this brief description of the action of a few chemicals shall have demonstrated to the reader that to employ such action wrongly, mistakenly, must bring about results detrimental to the organism which it is hoped to benefit. These, however, are points which can only be determined by experience and in these respects, and to save trouble, I quote :—

"*The physician who treats himself, has a fool for a patient.*"

CHAPTER XVII.

RECONSTRUCTION AND RECOVERY.

Reconstructive effect of the foregoing treatment. —On due consideration it will be seen that all of the foregoing methods of removing wastes and of re-establishing the proper interaction of the different parts of the body by the means of various modes of Motion, are also reconstructive in tendency and usually in direct effect. But little remains to be said, therefore, in regard to the process of building-up the organism. The food—properly prepared lean meat—which was recommended as the least likely to create unhealthy waste, is the food best calculated to nourish the body. The nourishment of the body is made possible and is directly assisted by the various forms of motion which have been reviewed; while the copious draughts of hot water—a form of Motion applied internally—remove accumulations of wastes, stimulate and give tone to the system, and allow large quantities of meat to be taken with perfect safety, by disposing of such parts of the meat as may have escaped digestion and assimilation.

Self-inflicted treatment. — A number of people have tried what they call "a meat diet," and have done so without medical advice or supervision. Is it to be wondered at that in such circumstances the diet does not always come up to the expectation of the sufferer? A meat diet, in certain cases, may be an effective means of cure. Electricity, in certain cases, may be an effective means of cure. But if some one, without proper understanding of electro-therapeutics, were to attempt to cure himself electrically and were to fail, he would scarcely be justified in condemning electricity as a therapeutic agent. It requires quite as much scientific knowledge and quite as much experience to prescribe a diet suitable to any given case, as to apply electricity effectively.

Scientific dieting.—The proportions of the various foods must receive special attention and consideration :—

(*a*) In regard to the constitution of the individual, and

(*b*) In regard to the malady from which he suffers.

The ability to reduce food to its elements must be considered in scientific feeding; thus it were idle, for example, to give quantities of Hydrocarbons (or fats) when the liver is weak. Also, besides considering the elements of a food, we must note that some foods are put together in such a way as to make it difficult for the organism to extract the nutriment, especially the weakened organism. Scientific research, by microscopic and chemical examination, enables the physi-

cian to say what a given organism can or cannot do. There is a possibility of superstition in all things, and the superstition about "healthy foods," so called, is as harmful as any, for a food may be in itself good, and be as useless as gutta percha to the body which is unable to dispose of it. The normal human organism is *made* after one pattern. But all bodies do not *function* after one pattern. This is partly owing to divergences caused by :—

(*a*) The original tendency ; and

(*b*) The environment.

It is necessary to find out what is the specific weakness of each. To discover what organ is weak in this man ; what juice is deficient in that man ; how the blood feeds or breathes abnormally in another ; what point of congestion or fibrous stoppage there is to breed microbes which poison the foods of a fourth. Each body is a chemical laboratory wherein vital processes are carried on. In each there may be departure from the equilibrium of health. Each functions under natural physiological laws ; but also each has sub-rules of its own, adopted in the struggle with circumstance, in the effort to cope with environment unfavourable to health. These efforts deepen into habits, which I have termed sub-rules, for they really have become rules to that organism ; they have become chronic departures from the laws of health. They are compromises, made necessary for a temporary purpose if the organism is to struggle with disease at all—crutches, needed by the lamed body. This body must be gradually aided to discard the

crutch. There is only one way to do this. We cannot disregard these habits of the organism in favour of theoretical perfections of either foods or functions. We must wean the body from its crutch while removing the need for one, and the body will resume the normal tendency, which is, to follow the laws of nature. *The very means taken by the physician may be a temporary crutch and must not be looked upon as finalities.*

As an analogy to the fact that all bodies do not function precisely alike though made after the same pattern, we have the fact that in the machine shop, the engines or any piece of machinery may be made on precisely the same pattern. Yet all machinists know that two locomotives, turned out by the same shop and on the same model, will each display quite different idiosyncrasies and peculiarities when they come to run on the rails. And each man has engendered idiosyncrasies in his bodily machine in the course of building it up.

Bread and other foods in chronic catarrh.—In many cases of chronic catarrh, of chronic rheumatism, neuralgia and kindred disorders, in which the formation and the accumulation of wastes plays an important part, it may be necessary to forbid absolutely the use of bread, potatoes, uncooked vegetables, puddings, pastry, sugar in any form, fried foods, iced foods, jams, jellies, and fruits. Milk, cream, fat, melted or cooked butter, cheese, pork, veal, shell-fish and the oilier kinds of fish and poultry, such as salmon, mackerel, eels, geese and so forth, may also have to be eschewed.

Diet in severe cases.—In severe cases the diet may have to be confined almost exclusively to meat, from which the fat, sinew, and gristle have been carefully removed by a special chopping and shredding process.

Beef the best meat, its preparation.—Beef is the best meat for this purpose. Properly prepared in this way, only the lean muscle fibres, the pure pulp of beef, remain over to be cooked. And the cooking also requires special supervision. With care and with knowledge, the beef by these means may be made more than half ready, before it enters the mouth, for direct assimilation in the stomach.

It will supply nourishment in a highly concentrated form, and in a form that can be easily assimilated, while giving the digestive organs the least possible labour to perform. In an appendix I give the proper method of preparing such meat, together with other hygienic recipes. *These are for those whose physician has directed such a diet.*

Amateur efforts at self-cure.—But I must express here emphatically my hope that no sufferers may attempt to experiment upon themselves. Experience has taught me the danger of amateur efforts at self-cure. I have too often been obliged to rectify the results of such efforts.

Uric acid poisoning.—Is not infrequently met with among those who have adopted a meat diet on their own responsibility and without medical advice.

A word of advice.—So I sincerely recommend those who wish to recover their health and who have heard of the immense benefits conferred upon other sufferers as the result of an exclusive meat or " Salis-

bury" diet, first to consult some physician who is properly qualified to advise on such a matter, and to follow his (or her) directions faithfully once they submit themselves to such treatment. They have chosen a guide through a strange and a difficult land ; let them then abide by that choice loyally and in good faith and heart.

Microscopical and chemical investigation necessary. — Constant supervision, by microscopical and chemical investigation, of the blood and the excretion, will show the effect of the diet upon the system, and will indicate the time to change or modify the diet in the right way, as designated by the result of these examinations.

Value of an exclusive meat diet and its modifications.—In those circumstances, and in conjunction with other treatment, it may be relied upon to work wonders.

Not the one infallible remedy.—It succeeds, time after time and in case after case, when all other remedies have failed. It is not put forward as the one infallible remedy, to suit all cases and to cure all ills. But this may be said for it :—

As a part of a system of treatment, and the essential part, and in many chronic diseases, this diet or modifications of this diet, will prove an invaluable aid in the recovery of health.

The co-operation of the patient.—It is particularly in matters of diet that the patient may find it most difficult to co-operate gladly with the physician ; and

it is just in this department of the recovery of health that glad co-operation is most necessary.

False hunger.—If the strict meat diet should be prescribed, many a pang as of hunger must be endured before a cure can be effected. Yet this will not be real hunger; it will not be due to lack of bodily nourishment. It will be the "fierce cry of poisonous microbes," and of other microscopical creatures among the wastes of the body, which call aloud for the food which they desire—for the fermentable foods, without which so many of them die. Above all, it may be due to organs which have become habituated to wrong conditions which are harming the patient, and which conditions, constituting chronic disease, it is now proposed to break up. As with the patient, so with each organ of his body in its own proportion and place: the organs too have to retrieve, to enter upon new conditions, to break up bad habits, *under the governing will of the patient's mind.* Remembering the effect of the mind upon the body, we can see why the co-operation of the mind must be glad and cheerful; if the patient *will* the cure, if he *will* health, he must also will the means of recovery, and with just the same joy with which he looks towards the bright prospect of that health. He can turn his mind towards that prospect and away from temporary cravings if he wills so to do. These cravings, which I have called false hunger, may merely be due to the sense of repletion which many associate with proper nourishment. This sense is really absent from a proper condition of the body after meals, as they will find later on, when a glow and a sense of lightness will take its place, if all

goes as it should. To feel that the stomach is full is not really to be well nourished. So we see that the gnawing sensation as of hunger may be due to more than one cause, and a knowledge of this fact is a great aid towards the cheerful endurance of it. To eat may relieve the trouble for the moment, only to aggravate it later.

Need of self-control.—But it is not easy to realise this, and the severest kind of self-control may have to be exercised in order to overcome a temptation which few can appreciate until they have actually experienced it. It should, however, be said in this connection, that in almost all cases, improvements in one or another form soon comes to compensate for this trial and to cheer the sufferer to continued effort. Also, in some cases this false hunger is never felt, but from the start the organism "takes to" the diet.

What recovery means.—Is not the recovery of health worth some sacrifice? Think of it, you who suffer, you whose suffering makes others suffer; you who, without actual pain, are the victims of constant pressure on the nerves which makes you irritable beyond endurance, or more dull and heavy than other human nerves can stand—what would you give to be well? And you can be made well, except in rare instances. To be well! To be full of health and vigour! To feel that you can face anything, endure anything, overcome anything upon the path of your life! To feel that great throb of life in your veins which some only know when from a high mountain they look down over hills and valleys and the cities of men, and when, with the free ether uplifting them,

they realise for a moment their power—the power of perfect interaction between mind and body, between man and nature. To feel like that is worth some sacrifice, for that is health, and wise are they who, having lost it, seek *with a whole mind* to recover and to keep it. Wise are they who trust the idea of the universe and the vast recuperative power of nature, and who humbly elect to work on with her towards the restoration of that balance which she, the great mother, is always willing to restore, that balance which alone enables mind to be sovereign over body. For those who crave this wisdom this book is written, with the earnest hope that it may at least aid them in their search.

APPENDIX.

THE idea underlying the treatment which has become widely known under the name of "Salisbury Treatment," and its modifications, may be simply expressed thus—

That the cure and the prevention of all disease (accidents and contagious diseases apart), lie in hygienic processes; and most of the errors which disturb health, reside in improper feeding.

Simplification of diet is, then, the main point. Of these simplified diets, meat, properly prepared, and guarded by hot water, is the best, because it rests all organs below the stomach.

Following upon this idea, we have special modes of examination and verification, and a series of safeguards and modifications along the line of feeding, accompanied by hygienic application of various modes of motion, all of which, taken together and under expert supervision, gradually lead the sufferer to assist in the restoration of the balance of health.

From all that has been said above, it may clearly be seen that in dealing with chronic ill-health, I regard the "Salisbury Treatment" as the main remedy. It must as clearly be understood that it is not the only,

neither is it the universal, panacea, for all the woes of humankind. But, on the other hand, experience has taught me that, properly applied,—and, above all, if faithfully carried out,—it constitutes one of the (if not *the*) most valuable weapons in fighting ill-health. The principle underlying it, is the foundation of hygiene, physical, physiological, and moral: the application of the principle to the given case is that which requires skill and training. I say this deliberately after having studied its application for nearly two years with Dr. Salisbury in New York, and then applying it myself in London for the last seven.

Consequently, knowing that many are interested in this treatment, I here give an outline of it, having indicated the reasons why such treatment is physiologically and pathologically necessary in the earlier parts of this book. It must, however, be well understood that this outline represents only an average case, and that quantities and instructions vary with each case.

Hot water.—One pint of water four times a day. The water should be at a temperature of 120° Fahrenheit, about the heat most people take tea or coffee. Try it once or twice with a thermometer and afterwards the lips will guide. It must be *sipped slowly*, at least 15 minutes to be consumed in drinking the pint. It must never be taken sooner than three and a half hours after a meal, and one hour should elapse before the next.

If a pint be regarded as too much, begin with less, and gradually work up; but get to the full quantity as soon as possible.

Children should, of course, have less, and not necessarily four times a day.

Those who take the four pints will often be found to want more, many people taking 6 pints a day with great benefit.

As in most parts of England the water is hard, the use of distilled water is advised. This can be obtained easily as a rule from any chemist, but it is better to prepare it for each person. The "Ralston Still" can be got from Messrs. Allen and Hanbury, Wigmore Street, costing two guineas. As distilled water varies in price from sixpence to ninepence per gallon, the cost will soon be repaid. The still is as convenient and handy as a kettle, and as easily managed on the kitchen range or gas-stove.

Meals should be five hours apart.

The quantity of meat must vary according to the individual. *Begin with little*, say two ounces per meal at three meals in the day. Get the chemical and microscopic assurance that this *is* well digested and assimilated, and then gradually work up the quantity from two ounces to four, six, eight and up to a pound at each meal. The meat should be weighed just before it is cooked.

But emphatically, the stomach must be made clean and sweet, and must not be overloaded with too much meat. If it is so overloaded, a host of troubles will be set up, and it is far more difficult to get rid of the results of such excess than it is to refrain from eating too much.

Such treatment is very simple in appearance. The difficulty is in carrying it out, and this depends on

the patient. At the close I give recipes for cooking, and these *must* be carried out faithfully. It is no use to play with health or to trust the cook to "know better." These recipes depend on practical knowledge of cooking and what is sought for in cooking, and on the results in the case of stomachs.

I also outline some details which may be of assistance.

Drinking the water.—Besides sipping it, lie on the left side while drinking. Then turn over to the right side for a short time, then back to the left. This position and its change help in dislodging any flatulence and are productive of great relief.

If the hot water itself is a difficulty or causes any nausea, a little sal volatile (20—30 drops), or compound spirits of lavender (30 drops), or carminative tincture (10 drops), or half-a-teaspoonful of bicarbonate of soda or the juice of half a lemon (no artificial substitute), will obviate the difficulty. These can all be given up in a few days.

One-half to a whole teaspoonful of pure cream of tartar in the first pint is often invaluable in clearing the system.

Above all, the hot water MUST *be persevered with.*

The meat.—This must be thoroughly prepared. In the average case it must be thoroughly cooked, it must never be raw, and should not be "underdone." If it is raw, there is the possibility of undesirable guests in the shape of tape-worm.

It must be so far as possible stripped of all fat, gristle and connective tissue or "fibre." This is not only to enable it to digest more easily, but because in

a "fermenting" stomach these also ferment and generate flatulent gases, and so far as I can ascertain in such a stomach more especially tend to the formation of leucomaines (see p. 131).

A lightly poached WHITE OF EGG (no yolk) is to many a welcome and appetising addition to the meat. And to some, *a little* lemon-juice (squeezed freshly on to the meat) is a most welcome and permissible assistance.

The meat must be chewed thoroughly well and eaten slowly. Even though it is properly prepared, it must be broken up and mixed with saliva so as to help the gastric juice to get thoroughly at it.

If patients say they want something to bite, let them take a little bit of grilled steak and bite this without swallowing the fibre.

To those whose stomachs are clear a little "baked bread" is allowed, and in some cases a very little *fresh* butter thinly spread on the toast.

But, emphatically, until a certain stage is reached patients are better without it. It is a compromise, and in the recovery of health in most cases "no compromise" is the surest method. The struggle for health, as is seen in the first chapter of this book, is a struggle of "life and death."

Fluid at meals.—In most cases as little as possible should be taken. In many it will not be wanted, thanks to the hot water. Clear weak tea (infused one to two minutes and then poured off the leaves); clear weak coffee (in either case without milk or sugar); a small teacupful of each.

Such is the "Exclusive Salisbury Diet." No starch

food, *e.g.*, bread, puddings, rice, potatoes, tapioca, biscuits, pastry, and the like. No vegetables with their starches and other constituents. No fats or as little as possible. No sweets or fruit; no jams, pickles or pies.

Merely hot water; thoroughly prepared meat in sufficient quantity; and a few condiments in small quantity, such as salt, black pepper (freshly ground), cayenne or still better Nepaul pepper, and a little mustard. This latter must also contain no vinegar, but be mixed with water or lemon-juice.

In brief, it requires patient perseverance, almost amounting to heroism. The thing is to resist temptation and by absolutely refusing all food liable to undergo fermentation not natural to the proper digestive process, to restore the balanced interaction of all parts,—the said interaction meaning health.

WARNINGS.

Never over-eat.—If patients do, they will have dyspepsia and flatulence: the best cure is a little (even 24 hours') wholesome starvation, with plenty of hot water to drink. So far as nutrition is concerned, anything overeaten is absolutely wasted and furthermore means a serious burden to be got rid of. Mind and body alike feel as heavy as lead, and hands and feet are as cold as stones under the effort of the circulation to wash away the excess. Each stomach is and must be a law to itself in regard to the quantity eaten. It

is no use to try and "feed up" to a given quantity, for the power to digest will vary in different parts of the day, and even from day to day. This too will vary with bodily fatigue, and emphasizes the need of at least half an hour's rest before and after meals. But flatulence may also arise from emptiness, so that we thus see the need for the *right* quantity of food. This form is especially apt to arise in the night, bringing in its train waking dreams of a torturing nature and a sense of exhaustion peculiarly distressing. Then on waking in the morning, in place of being refreshed and light, the patient is exhausted, weary and good for nothing. This is a case in which good beef-tea, or a few mouthfuls of mince, or even a "sandwich" of Carnrick's Peptonoids will prevent all distressing symptoms and put an end to these wakeful fidgets by night as well as by day. See also in this case that the bed is comfortable, and that neck and back and in fact every part of the body is well supported.

Such fidgets are especially apt to come when patients are getting better. In these cases a ravenous appetite is apt to come on, and yet there is difficulty in digesting, and still more in assimilating the quantity of food necessary for thorough nutrition at any one meal. In these cases it is absolutely necessary to carry about a little mince or a sandwich to take once if not twice between meals, and thus get enough food without taking too much at any one time. The best times for "extras" are two hours after the first two meals, and about 2 a.m.

To emphasize the warning, Nature has given certain signs: if patients feel listless and heavy after meals,

or if they are at once distended with flatulence and they get sour risings into the mouth or have heart-burn ; or if they get chilly and find themselves yawning, or above all get hungry at once after a meal—let such indulge themselves in a little wholesome starvation, for they have over-eaten.

Let people take their own experience of this, and not trust to the wishes of servants or above all of "sympathising friends." The cook, too, becomes a most important person, for if the said cook prepares the meat wrongly, or is careless in doing so, dire will be the result, and discouragement and disappointment wlll season the diet.

Loss of weight.—Do not make a fetish of the weighing-machine or the length of the waist-band. While they are valuable guides, do not give them undue importance. Loss of weight must occur, and in clearing the system the flesh put on under unhealthy conditions is best got rid of, or it will be as much a source of weakness as rotten or bad mortar is in a building.

If, however, such common-sense considerations as the necessity for clearing the foundations of health completely, and the necessity of using only sound materials in the building, do not prevail, and the patient has not enough philosophical faith in Nature, his own powers, and the correctness of what he or she is doing, let this form of effort be stopped, the search for *cure* abandoned, and let such patients rest content with such relief as they may obtain by other methods.

Patience is needed, philosophical content too, courage also, and a firm and abiding faith in the

patient's own power and ability to secure the Restoration of Health. Armed with these the strong man or woman keeps his own citadel of health and builds it up stone by stone.

These points lead up to the consideration of—

Weakness.—*So armed and securing proper cooking and taking the needful rest, no patient need be weak.* Even when the sufferers have been large eaters of sugar and starch and alcoholic fermentation has been rife in their stomachs, so that such patients actually miss their alcohol, the weakness can be avoided. But these *must* rest and indulge in no society "wear and tear," household management, long walks, worrying business, or church attendance.

But armed with the moral resolution and aided by physiological rest and freedom from care and worry, no weakness is necessary, and such time is not wasted, and money spent in securing this is money gained.

All this can be secured by care in understanding what patients are told and intelligence in carrying out the details. For in a "system of treatment" the details act and interact, and the omission of a single point may involve putting the machinery out of gear. I dilate on this point because I have had to deal with cases in which unnecessary suffering has been caused by failure to carry out details carefully explained, which, though small apparently, were essential to success. It is so hard to break up habit of thought, and method of living.

Constipation.—This to some extent will certainly occur. It must be regulated and overcome by the use of some such thing as cascara or phosphate of

soda, so that a comfortable action is secured every day. The injection of warm water with glycerine in it is oftentimes invaluable ; and in some cases marked improvement will come from the use of a large douche of warm water injected as high up as possible. But this should only be done under direction, as such injections may cause the stirring up of very unpleasant material which has been slowly poisoning the system. It *has* to be got rid of, but its sudden stirring up may be accompanied by an apparent aggravation of trouble.

Stimulants.—The less the better. Those who have been accustomed to such aids, had better take a very little and gradually leave off, for they will find that, as said before, the hot water will prove quite enough stimulant, especially with the meat diet.

To enable patients to commence their diet under favourable circumstances and competent supervision, "Homes" have been opened in various parts of England.

In London:

MISS JEWSON, *who was formerly Night Superintendent at St. Bartholomew's Hospital, and was herself a great sufferer is at*
No. 7, Avenue Road, Regent's Park, N.W.

MRS. MCINROY, *who was for some time with Miss Jewson, is at*
Kurrajong, The Bank, Highgate, N.

MISS L. JOHNSON, *at*
14, South Hill Park Gardens, Hampstead.

In the Country:

MRS. YOUNG,
17, Devonshire Place, Eastbourne.

MISS CORSELLIS, *Miss Jewson's partner, is at*
Corbar Tower, Buxton, Derbyshire.

There are also many other places where the diet can be obtained, excellently prepared.

RECIPES.

When patients are long upon an exclusive meat diet, this is apt to weary. For this reason, certain variations, which have been invented in the household of the writer, and which are in frequent use there, are here given. They are the result of careful experiment, and have been drawn up with extreme care, and if followed with the same care, make the meat palatable without making it indigestible. But to achieve this end there must be no deviation from the letter of the law, or the recipe. The quantities given are for one meat cake of eight ounces; where more or less than this medium quantity of meat is prepared, the recipe must be altered proportionally. If any one flavour be preferred, the stock can be flavoured in that way at one time and used as the cakes are cooked. To do this, it is only necessary to measure the stock in cupfuls and to increase the materials, taking two cupfuls to be the same as the eight ounces of solid meat-cake. Or the stock can be seasoned in the usual manner, the cook using her judgment as to quantities.

One word in regard to serving the diet. It should be remembered that the imagination plays a large part in the appetite of the sick. Therefore the diet should be nicely served and garnished, if only with fresh parsley, when nothing else is allowed. It is hard enough to be cut off from all the dainties of the table and from one's own preferences, without having to give up the niceties as well.

The cook can aid the physician in many ways by her forethought and care ; she can often make or mar a part of his labours ; and in the matter of nice service she can do much for the appetite of the patient.

The first dietary here given, is for those who are confined to the strict meat diet. The second, or more advanced dietary, is for those for whom it is ordered, and to save the endless work involved in giving recipes to every patient it is thought well to print them once for all. But all these dishes *are only intended for those for whom each dish has been ordered, and for no others : nor should any patient try any dish beyond the ones ordered for his or her especial case. This dietary is throughout a matter of scientific exactitude : no dish must be altered by my patients without my permission ; the exclusions, no less than the inclusions, have a meaning and a good reason.*

PREPARATION OF THE MEAT.

BEEF MINCES AND BEEF CAKES.

Articles required.—Enterprise chopper, No. 5: can be got from the Enterprise Hardware Co., 86, Dale Street, Liverpool; Benham & Co., 50, Wigmore Street, London, W.; or the Stores. Enterprise griller. Enamelled saucepan. Wooden spoon and rolling-pin with round end.

The meat is to be from the top side of the round, best cut absolutely fresh, and preferably from Scotch animals. Meat that has a glaze upon it, or meat that is very dark in colour, must be rejected; above all, meat that has been frozen is not to be used, or the mince and cakes will always be a failure, and will be very leathery and indigestible.

Put the mincer together and after screwing up the plate in front, give a little less than quarter of a turn backwards; this will enable the mincer to strip the fibre from the meat much more thoroughly.

It is best to get the meat ready for each meal separately. This is absolutely necessary in summer, for the moment the meat is minced it tends to go sour in hot weather. Cut the meat in pieces, and pass from three to six times through the machine; then place the meat in the saucepan and mash with the end of the rolling-pin. Then stir in water or beef-

tea, according to the quantity required, and the nature of the meat (whether more or less dry), taking care to **never** let it be sloppy when mixed. During the whole of the cooking, the mince, of which we are now speaking, must be of the consistency of soft putty. Experience shows, except with very juicy meat, a teaspoonful of liquid for each ounce is required. Ascertain the exact weight of your saucepan, and then the chopped meat should be weighed, when this is necessary, in the saucepan, or when moulded into a cake, and before cooking.

To make the special mince, now place the saucepan on the cool end of the stove, or on a hotter part on an asbestos mat, or on an oven tin with an asbestos mat over a gas flame. The heat at which this mince is cooked must be such that you can always touch the bottom of the pan with your finger. If allowed to get hotter and to cook faster, the mince will be spoiled *for the purpose of digestion.*

During the whole time of cooking the mince must be thoroughly stirred round and round and turned over and over: never permit the mince to rest on the bottom of the saucepan or to cake on the sides.

From 25 to 35 minutes are required for this process at this heat.

At the close of stirring, a little salt and pepper may be added, celery salt giving a very good flavour; a little cayenne pepper may also be used. The mince should be very hot, and must be served at once when the cooking is finished; it should never be allowed to stand; these directions apply to the beef cakes as well.

For the beef cakes an Enterprise griller is needed, well rubbed over, but not plastered, with fresh (not cooking) butter. The meat should be turned out of the bowl after

using the rolling pin, and shaped into a cake of about rather over an inch thick, with the back of a knife.

Never press in shaping the cake so as to sadden the meat.

With a fish slice, lay the cake in the griller and hold it ten inches above a clear bright fire; count ten and turn to the other side. Usually this process will take about ten minutes, by which time the meat will be thoroughly cooked through and will not be pink inside.

The great point is to avoid all unnecessary pressure or handling of the meat, which is apt to go sour or sad in the cooking without due precaution as to handling it.

Another method of Preparing the Beef Cakes (No. 2).

Chop as before. Turn into a bowl and mix into it, with a wooden spoon, some beef juice or beef-tea, sufficient to moisten: then mould with the knife blade as before. This method ensures the moisture of the meat, and I have found that some cooks who do not succeed with the former method make delicious meat cakes by this method. All the ensuing recipes for meat cakes are based upon this method, but the cakes can be seasoned in somewhat the same manner by the first method given, only the beef-tea, in some instances, is seasoned and is then poured hot over the hot cake before serving.

STOCK.

This stock may be used as a gravy, a small quantity being seasoned, heated and poured over the meat. It may be used to moisten the meat cakes before these are broiled, and is the best thing for that purpose. It can be kept for several days in a cool place. It forms the basis for all the variations in the preparation of the meat as given hereafter.

Take one and a half pound of the shin of beef. (Or mutton can be used, when allowed, or both meats, even in scraps left over from household use, *always provided that no fat or fatty particles or gristle be used.*)

One quarter of a pound of *lean* bacon.

Two pounds of bones.

Three quarts of cold water.

Boil slowly down to two quarts. When cold it should be a firm jelly. Strain and set aside for use.

MEAT RESTORATIVE.

Take a cupful of the above stock. Add a teaspoonful of fresh parsley, chopped, half a teaspoonful of celery seed, a dash of salt, another of pepper (freshly ground if possible), and heat all up together. Strain and set aside on the ice or in a cold place to harden: when quite cold, take a teaspoonful at a time as a jelly.

BEEF-TEA.

Cut one pound of lean beef into small pieces and pour upon it one pint of cold and filtered water. Place, after stirring slightly, in a jar which can be well corked, and let

it stand about half-an-hour. Next stand the jar in a saucepan or kettle of water, which should cover the jar up to the neck, and let the surrounding water boil for an hour. Remove the jar and pour the contents through a strainer; season and serve. The fine sediment which will be found to run through the strainer will do no harm. This is the method used by a prominent American surgeon for all his cases, from which gentleman the writer had it. This method yields a sparkling beef-tea, so to say, of fresh flavour, and does not extract the gelatine as the usual process does.

The jar may also be placed in an oven for an hour, without being surrounded with water. But this method, used in England sometimes, does not appear to be so much liked.

BEEF-TEA, No. 2.

Cut three pounds of lean beef into pieces, and put into a jar with sufficient cold water to cover the meat. Lemon peel, celery or spice may be added. Place in a jar and set this in a saucepan of water, put on the fire and simmer gently about three hours, or more if required. Then strain and set aside for use. The salt must not be added to any of these recipes until the food is ready to serve. (In the case of the meat cakes, it is added by the patient when about to eat it.)

This tea is still more nourishing if double the proportion of meat to the water be used, in cases of great weakness.

The flavouring as given above may be omitted.

Liebig or Bovril may also be used for moistening the beef cakes.

BURNABY FILLET.

One kitchen cupful of stock, beef tea or Bovril.

Two good sticks of celery, cut up in inch pieces.

Small bunch of parsley, tied in muslin.

One teaspoonful of onion juice. (Can be omitted.)

One teaspoonful of lemon juice.

One level teaspoonful of celery seed.

One bay leaf.

Dash of pepper; dash of salt; when eaten, not before.

Put into a saucepan and simmer well for fifteen minutes. Take out, strain, and use a portion to mix the eight ounce meat cake (see Recipe No. 2 for this method); pour the remainder, if any, over the meat cake, garnish with parsley and serve very hot.

COLUMBIA SPICED MEAT.

One kitchen cupful of stock, or other beef juice.

Six whole cloves.

Pinch of pepper-corns.

Grating of nutmeg.

Dash of pepper; dash of salt; when eaten, not before.

Put in a saucepan, simmer for fifteen minutes. Remove and strain. Use to mix the eight ounce meat cake, as in Recipe No. 2. When served, salt to taste and a dash of lemon juice.

WILDWOOD FILLET.

Take sufficient of the chopped beef for an eight ounce cake. Add to the chopped beef, one teaspoonful of onion juice, one teaspoonful of dried tarragon chopped fine, one

teaspoonful of chopped fresh parsley; mix with two tablespoonsful of plain stock. Mould and cook the meat cake as usual. Serve garnished with parsley and a quartered lemon to squeeze over it. The seasoning can be increased or diminished if desired.

FILLET AUX ŒUFS.

Take sufficient chopped beef for an eight ounce cake. Prepare some Plasmon by slowly adding one teaspoonful of the Plasmon powder to half a kitchen cupful of tepid water, place over the fire and stir until completely dissolved. Then mix with the beef cake as in No. 2 recipe, adding more moisture than usual, whether of water or of beef juice of one or another kind. Enough must be used to render the cake so moist that it can just be handled, with care. This is because it is found that the Plasmon tends to sadden the beef cake unless more moisture be used. But there is no difficulty about using the Plasmon if this precaution be duly observed, only the cook must make up her mind to be obliged to use more care and dexterity in handling the cake. Flavour the cake with one teaspoonful of Worcester sauce, if this be liked by the patient.

While the meat is cooking, poach lightly the whites of two eggs, and serve hot upon or around the meat cake, garnished with parsley. Salt and pepper just before eating.

ANCHOVY MEAT.

Take two teaspoonsful of the Plasmon powder, four tablespoonsful of water and mix well together. Then add, slowly, one half-cupful of tepid water. Put over the fire, bring to a

boil. Remove, cool, and add one teaspoonful of anchovy sauce well rubbed into the cold Plasmon paste. Mix the beef with this instead of using stock or other beef juice. You may find that the cake requires more moisture, when use a little water or beef juice, etc. The essential thing, when using the Plasmon, is to make the beef cake more moist than usual, and to then cook it quite slowly and carefully. (See the recipe before this for further remarks on this head).

The Plasmon can of course be mixed with the beef without any anchovy or other flavouring whatever. If any of the anchovy Plasmon should remain over after the beef is prepared, it can be poured over the beef cake before serving.

When this sauce is thus prepared, about two tablespoonsful of the Plasmon mixture (after preparation) is sufficient for an eight ounce beef cake.

ANCHOVY SANDWICH.

Two teaspoonsful of the Plasmon powder mixed with four tablespoonsful of tepid water. Then add a small half cup (or less) of lukewarm water on the stove, mixing it and stirring well. Bring to a boil, then set aside to cool, first adding one teaspoonful of anchovy sauce. When quite cold, the mixture should be a butter. If not, too much moisture has been added, and you must thicken it over the fire on the addition of another teaspoonful of the Plasmon. When quite cold, this butter is to be spread on slices of the thin toast, or baked bread, the preparation of which is given in the next recipe.

BAKED BREAD.

With a very sharp knife, cut stale bread into slices four inches long and one inch wide. It must be as thin as possible, which is about six lines or so. Then place in a pan in a quick oven, and bake it through and through, taking constant care and watchfulness to prevent it burning. It is done when it is a light brown in colour all over.

PLASMON SNOW.

Take four teaspoonsful of Plasmon and mix to a smooth paste with two tablespoonsful of cold water; then add, slowly, one and a half kitchen cupful of tepid water. Let this come just to a boil, and sweeten with five scoops of saccharine, mixed with a very little water and stirred into the Plasmon just before removing it from the range; add vanilla essence to taste. (The scoops are the measure which comes with the saccharine powder. If it is not to be had in powder, then the cook must judge of the proper amount of saccharine to use.) Cool the mixture on the ice, or set in a bowl plunged in a larger bowl full of cold water, and place in the coolest spot you have to cool thoroughly. When quite cold, whip to a stiff cream. It may take half-an-hour to whip, depending upon the place and the weather. Serve in a glass cup or tumbler at once after whipping.

QUICK BEEF-TEA.

When beef-tea is required in haste for an invalid, cut into very small dice sufficient raw beef to fill a large kitchen cup heaping full. Put this into a small saucepan

and pour over it two tablespoonsful of quite cold and filtered water. If you have not a double kettle, set your saucepan, closely covered, over the top of the kitchen kettle, the water of which must be boiling. Steam thus for ten or fifteen minutes. Take off, season with celery salt and pepper, strain the juice off and serve in a cup previously heated.

SALISBURY RICE SCONES.

(Given by the inventor, Dr. Salisbury.)

Boil a teacupful of whole rice until very soft, say about two-and-a-half hours. Add water enough to make a thick batter, a quarter of a kitchen cupful of *sifted* flour (measured after it has been sifted), into which a level teaspoonful of baking-powder has been stirred. Last of all a pinch of salt and the white of one egg, well whipped. Heat in the oven your gem pans, or any small cake pans for little cakes, and grease them with good butter. Pour into them the batter and bake in a hot oven for thirty minutes. To be eaten with a little butter (if this be allowed), and salt if more be required.

These are in the nature of little cup cakes and take the place of bread: they may be eaten cold, but are preferable hot.

PLASMON RICE CAKES.

Boil one teacupful of whole rice until quite soft. Mix over the fire one teaspoonful of Plasmon powder with half a cupful of tepid water until quite dissolved; then use to make a batter of the rice; add four tablespoonsful of *sifted* flour into which a teaspoonful of baking-powder has been

stirred, and a pinch of salt. Last of all the whites of two eggs, well whipped. Pour the thick batter into small cake pans which have been heated and rubbed with butter. Bake half-an-hour in a hot oven. Use your judgment as to whether you require more water to make the batter, and if so you can add a little cold water to the batter, which should be thick. No fixed rule as to the quantity of water can be given, as both the rice and the Plasmon vary. These cakes may be sweetened with a little saccharine if desired in some cases.

RICE GRIDDLE CAKES.

Boil one cup of rice until very soft. Add two even tablespoonsful of flour, a little salt, the whites of two eggs well whipped, and sufficient water to make a very *thin* batter. Just before using add a half teaspoonful of baking-powder. Pour the batter in small rings upon a soapstone griddle on the top of the range (first heating the griddle through), and bake slowly. If you have no such griddle, use an iron one with a dash of meat suet upon it. Serve as pancakes, but without rolling, and in piles of three or more, one on the other. A sauce may be made of a little hot water and a tablet of saccharine dissolved in it, with vanilla essence. Or a dash of lemon juice when eating, the slices of lemon being served with them. If preferred, the saccharine may be dissolved and mixed with the batter. Also cinnamon or nutmeg may be sprinkled on just before serving.

GLYCERINE TONIC.

Mix, in the order named, the whites of two raw eggs slightly beaten, two teaspoonsful of the purest glycerine, five tablespoonsful of cold filtered water, and beat lightly together; add one tablespoonful of the best brandy and nutmeg to flavour. Take all, or half, according to directions, once, twice or three times daily.

The same tonic may be made without the glycerine in cases where this is not allowed, and it may then be sweetened by the addition of a tablet of saccharine, or less, to the water.

MEAT SAUCE.

To make a beef cake tasty, take two teaspoonsful of Bovril, or any stock or beef juice; heat thoroughly. When it is very hot, mix into it a half teaspoonful of prepared mustard, or French mustard, salt and pepper to taste. Pour over the hot beef cake and around it and serve.

MORE ADVANCED DIET.

STEWED CELERY.

Six sticks of celery. One teacupful of stock. One teaspoonful of Plasmon. One blade of pounded mace. A dash of nutmeg. Pepper and salt to taste.

Wash the celery and cut it into pieces of about two inches in length. Dissolve one teaspoonful of Plasmon gradually with the cup of stock over the fire. When dissolved, place the celery into the saucepan with this; add the mace, nutmeg, pepper and salt. Stew until tender. This should take about twenty minutes. Remove the mace and serve.

PLASMON BROTH.

To one cupful of Bovril, or other beef-tea, &c., add a teaspoonful of Plasmon previously dissolved in two tablespoonsful of warm water. Mix this thoroughly until well incorporated in the broth, letting it boil up once. Poach the white of one egg and drop into the broth bowl and serve at once.

PANNED OYSTERS.

(American.)

Place six deep-sea oysters in a colander and pour cold water over them. Drain for ten minutes. (The water and liquor are useless.) Heat an iron frying-pan over a quick

fire: when the pan is so hot that a drop of water dropped upon it causes it to hiss, drop in the oysters; shake and stir them about until they boil. Then add salt, pepper and butter the size of a walnut. (Those who are not allowed butter must use a teaspoonful of beef jelly.) Place the oysters on and about a beef cake, and serve garnished with parsley and slices of lemon, which can be squeezed over the oysters if desired.

BROILED OYSTERS.

Choose six deep-sea oysters of the largest and fattest size. Lay them on a board, dry with a cloth, season with salt and red pepper (cayenne) on both sides. While you do this your gridiron should be heating thoroughly; test with a drop of water; when it hisses the gridiron is ready for use. Stand the dish in which you are about to serve the oysters in a warm place at the side of the range, putting in it a teaspoonful of butter. Cover the gridiron with the oysters; and brown the oysters first on one side and then on the other. Put in the heated dish and serve at once.

If butter be not allowed, a dash of beef jelly can take its place.

PHILADELPHIA OYSTERS.

Take eight deep-sea oysters. Drain, place on a board, and season with salt and cayenne. Put half a cupful of oyster liquor on to boil; when it boils, skin and add one half-tablespoonful of best butter, salt and cayenne to taste. Grease an oyster broiler, place the oysters evenly in it, close and broil until brown, first on one side and then on the other. Throw the oysters into the hot liquor and serve.

BRAISED CHICKEN.

Take a young chicken; draw, singe and truss. Put in a baking pan half a small carrot and one onion, sliced, with four cloves and a sprig of parsley, and then place the chicken on top. Pour over this one pint of stock (made from previous recipe), one teaspoonful of salt and a dash of black pepper (freshly ground if possible); cover the pan well and place in a quick oven for an hour and a half, basting every fifteen minutes. Dish the fowl on a hot dish. Strain the liquor into the pan; add six mushrooms chopped fine; replace this in the pan and stir until it boils up. Remove, season to taste and pour over the chicken.

CHICKEN PILAFF.

After cleaning the chicken, cut it into slices. Put in a stew-pan, half cover with boiling water, and set on a moderate fire to simmer. Wash half a cupful of rice, add it to the chicken with a teaspoonful of salt, and let all simmer slowly together until the chicken is quite tender.

Take a cup of the stock made from a previous recipe, heat it and dissolve thoroughly in it a teaspoonful of Plasmon previously mixed with a little tepid water. Pour this over the chicken and rice and serve. The Plasmon may be omitted. When permitted, three chopped mushrooms may be added to the stock and boiled up once before being poured over the chicken.

BROILED FILLET.

Cut fillet of beef into slices one inch thick. Moisten each slice with olive oil of the very best quality, and let stand half an hour. Place the slices on a broiler and broil about five minutes over a quick fire, turning the slices over several times. Serve on a very hot plate, season with salt, pepper and a teaspoonful of Harvey or Worcester sauce (where this is allowed) mixed with one tablespoonful of hot stock or beef jelly.

Ordinary steak, if very tender, may be prepared in the same way. But it must be naturally tender, and not beaten in any way to make it so, as this bruises and also drains off the juices.

BROILED SWEETBREADS.

Throw the sweetbreads into cold water the moment they come from the butcher; soak one hour, trim off all fat, and put into boiling water with one teaspoonful of salt. Parboil thus fifteen minutes over a moderate fire. Throw into cold water for five minutes, then remove all skin membrane and rough parts. Then put into a cold place until ready to cook further, but first cut into slices.

It is best to cook them in a granite or porcelain saucepan. When ready to broil, season the slices with salt and pepper, and baste with a very little of the purest olive oil (unless butter be allowed); serve hot when a nice brown.

BOILED SWEETBREAD.

Parboil a sweetbread as in previous recipe. Trim and set aside to cool. (Or proceed at once if desired.) Place in a saucepan half a tablespoonful of stock (see previous recipe for stock) and one teaspoonful of Plasmon first thoroughly dissolved in half a cupful of tepid water and stirred over the fire until it boils up once. Then thoroughly incorporate this with the stock. Place the sweetbread in the saucepan for a few minutes, letting all simmer together, and serve with the stock poured over it. The Plasmon may be omitted where not ordered.

RICE PUDDING.

Boil a teacupful of rice until very soft. Add a quarter of a cupful of sifted flour (measure after sifting), into which a teaspoonful of baking-powder has been stirred. Add water enough to make a *thick* batter, the whites of two eggs well whipped (the last thing), four scoops of saccharine dissolved in a little of the water, vanilla or lemon essence. Put in a baking dish, bake about thirty minutes in a hot oven. Grate nutmeg over it (some may be put in the batter if liked), and serve in the baking-dish, hot or cold. It is nice with Plasmon Snow as a cream over it.

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